THE HEATING AND VENTILATING MAGAZINE

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Forced Circulation Hot Water System With Boilers Used Interchangeably for Steam and Hot Water

SANATORIUM OF THE METROPOLITAN LIFE INSURANCE COMPANY, MT. MCGREGOR, N. Y.

The system of heating which has been installed by the Metropolitan Life Insurance Company in its sanatorium at Mt. McGregor, N. Y., is of particular interest because of the special features which have been incorporated in order to meet the peculiar heating problems and because of the thoroughness with which the system has been laid out to cover both the present and future requirements.

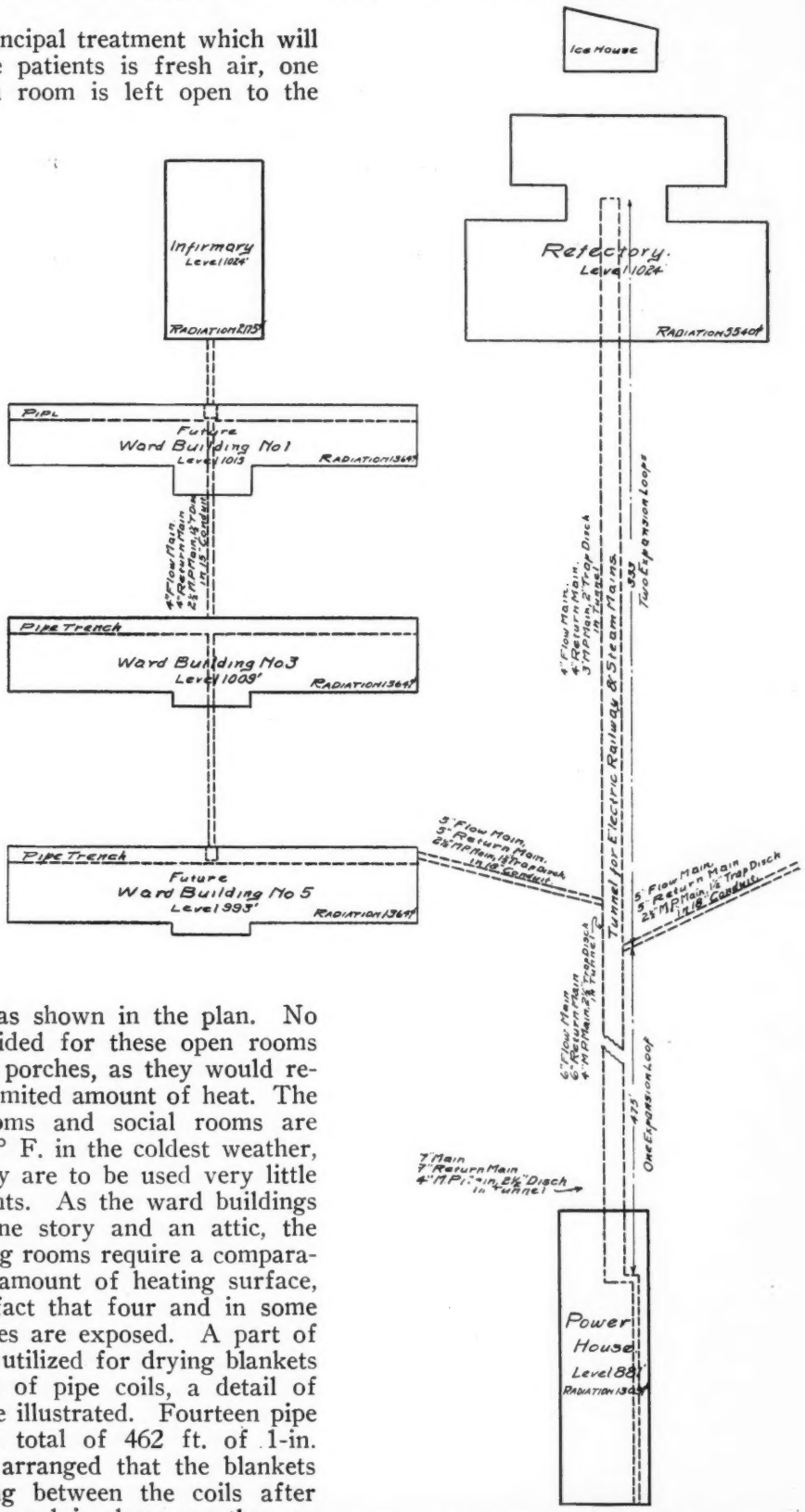
The sanitorium, which is to be used for the treatment of comsumptive employees, has been so constructed that all sleeping and living rooms for patients will be open to the fresh air, while the dressing and other rooms are heated. For this reason a comparatively small amount of radiation is distributed over a large area, with a grouping of radiators which is not ordinarily met with.

The group of buildings which is now being completed and which is to be heated by one central plant includes the power house, two ward buildings, an infirmary and a refectory. The relative location of the buildings may be noted in the plot plan. The four other ward buildings and administration building, which are also shown, will be built as soon as possible after the present ones are completed.

According to the original plan the nurses' cottage and superintendent's residence, located 500 ft. from the administration building, were to be heated by the same central plant. As the first cost of mains and conduits to these buildings was prohibitive, a hot water heating system was installed in each building. The farm group, which consists of two cottages and a large barn, is located about one mile from the main group. The barn will have a high pressure steam system installed for operating the pumps and dairy apparatus and for heating. As the cottages are being built as cheaply as possible a one-pipe gravity return system is being installed in each one, with the total amount or radiation reduced to a minimum in each case.

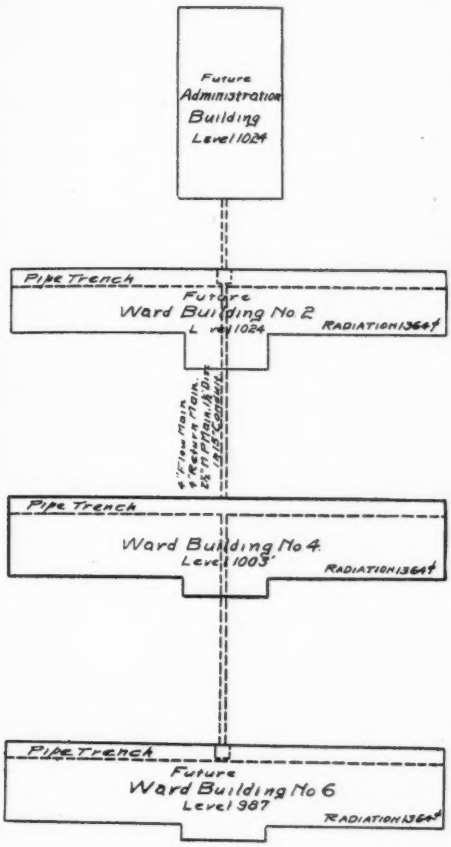
The six ward buildings are to be used exclusively by the consumptive patients as sleeping and living quarters. For this reason each patient is to have a small dressing room and a large sitting room which opens directly onto the open sleeping porch. Each of the ward buildings will be a duplicate of the two which are now being built and a typical main floor shown herewith. Each will have thirteen rooms, with a dressing room for each; two bath rooms, a quiet room, a nurses' room, two sleeping porches, an attic and a barber shop in the basement of those that are occupied by men.

As the principal treatment which will be given the patients is fresh air, one side of each room is left open to the outside air, as shown in the plan. No heat is provided for these open rooms and sleeping porches, as they would require an unlimited amount of heat. The dressing rooms and social rooms are heated to 70° F. in the coldest weather, although they are to be used very little by the patients. As the ward buildings have only one story and an attic, the small dressing rooms require a comparatively large amount of heating surface, due to the fact that four and in some case five sides are exposed. A part of each attic is utilized for drying blankets by a system of pipe coils, a detail of which is here illustrated. Fourteen pipe coils with a total of 462 ft. of 1-in. pipe are so arranged that the blankets may be hung between the coils after having been used in damp weather on the open porches.



PLOT PLAN OF BUILDINGS, MT. McGREGOR SANATORIUM.

Almost all of the radiators in the ward buildings are located on one side of the building, so a pipe tunnel was run



through the full length of each ward building to accommodate the local mains and trunk which pass through these buildings. This tunnel is shown under each of the ward buildings on the plot plan and in detail on the basement plan of the ward building. When the trunk mains leave the pipe tunnel of the ward buildings an 8 ft. expansion loop is placed in each trunk main and the local mains which supply the building are taken from these expansion loops near the ends where they are anchored. In this way the contraction and expansion of the distributing mains is confined and not transmitted to the local mains, thus obviating any leaks or breaks which might occur if the local mains were subjected to the same lateral movement. The detail of a typical expansion is shown in the pipe trench illustrated in the basement plan of the ward building.

Medium pressure steam is supplied to a hot water tank in each ward building which has a capacity of 600 gal. per hour.

The infirmary is a two-story building which is to be occupied by the more helpless patients. On the first floor are twelve rooms for patients, constructed according to the general plan used in the ward buildings, with an open room and enclosed dressing room, but with no sleeping porch. In addition to these rooms, a diet kitchen, two baths, a nurses' room and a surgical room are on the first floor. The second floor is practically a duplicate of the first, while the basement has seven rooms, an autopsy room and a hot water heater room. All rooms are heated, with the exception of the twenty-four sleeping rooms. Two risers have been run to the attic and capped for future use in case the attic should be used later. A medium pressure steam main supplies steam to the hot water heater which is designed to heat 690 gal. of water per hour. Medium pressure steam is also supplied to the steam table in the diet kitchen, to the sterilizer in the surgical room and to plugged tee in the laboratory.

The refectory is to be used as the main dining room. It will also contain private dining rooms and kitchen, with doctors' offices, X-ray room, storerooms, etc., in the basement. The manager's office will be located here until the administration building is completed, when the rooms occupied by the administration department will be used for additional doctors' offices and consultation rooms. The second and third floors will be used by the help employed in the buildings. All rooms will be heated to the usual room temperature. In this connection the building has an unusual amount of glass and, for this reason, requires more radiation than usual. Medium pressure steam is provided for the hot water tank which heats 600 gal. of water per hour. The kitchen also requires medium pressure steam for the vegetable cookers, steam table and other kitchen apparatus.

The administration building, which will be used for offices, will be of prac-

tically the same size as the infirmary, but, owing to the fact that it will require heat for all rooms, it will have more radiation than the infirmary. It requires practically the same amount of medium pressure steam as the infirmary.

The basement of the power house, which is shown in the accompanying illustration, will be taken up entirely by the boilers, generators, pumps, etc. All of the first floor will be used for the main laundry and the second floor will have fourteen open rooms, with a dressing room for each. The attic is not to be used at present, but provision for heat is made by running two risers to the roof. All the laundry rooms are heated, but such rooms as the sterilizing room and ironing room have only enough heat to keep the water pipes from freezing when the laundry is not in operation. The laundry apparatus alone is sufficient to heat these rooms to a suitable temperature. As the open rooms on the second floor, which are not heated, are on the outside of the building, this would have brought all the radiators in the dressing rooms in the center of the floor. It was not possible to bring risers through the center of the laundry, so main risers were brought up to supply mains on the ceiling of the first floor and from these were taken the radiator branches. Medium pressure steam is supplied to all laundry apparatus and to a hot water tank in the basement with a capacity of 450 gal. of water per hour.

FACTORS IN DETERMINING BEST SYSTEM OF HEATING.

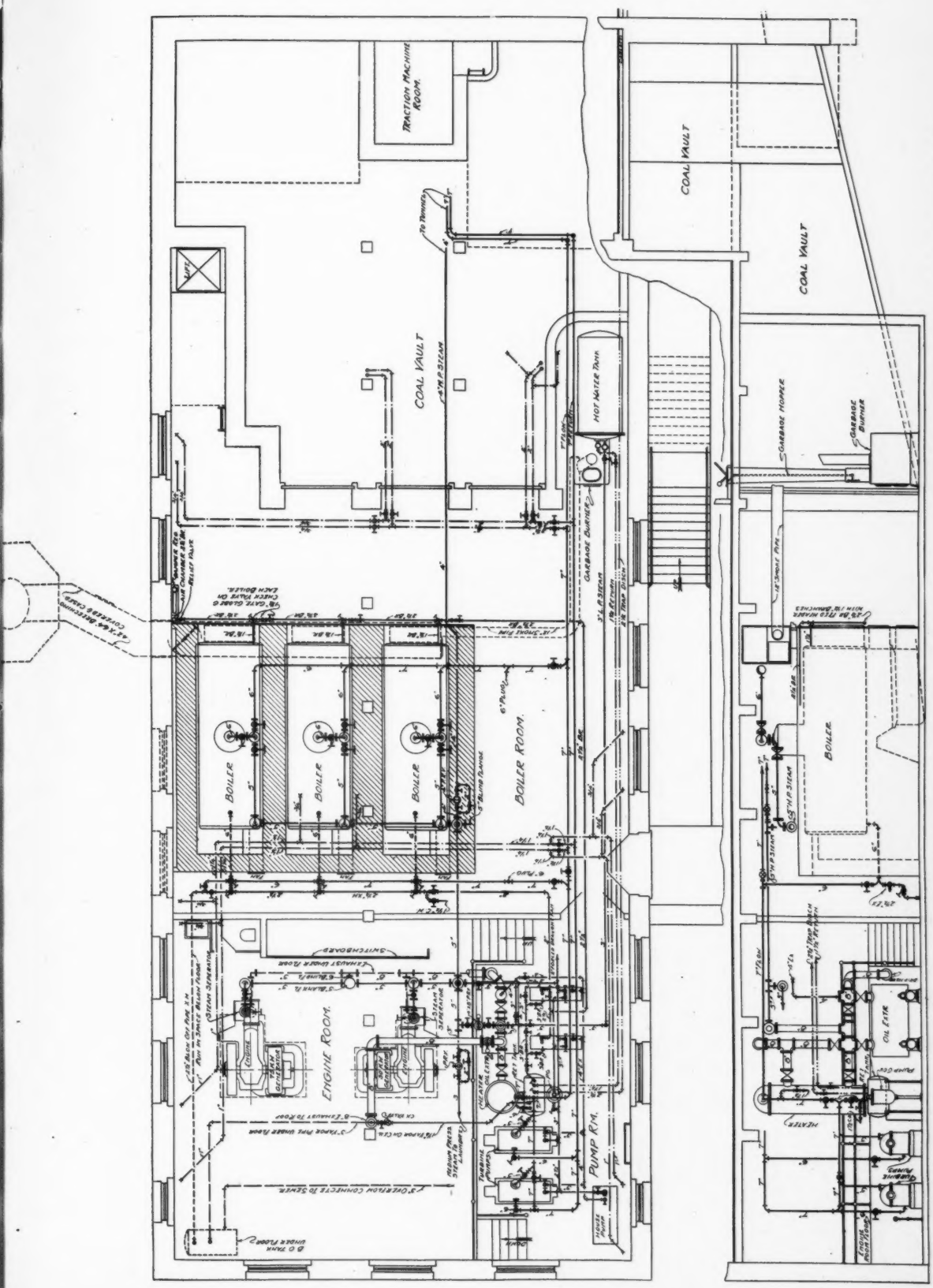
After the definite location of the buildings was determined it was then necessary to decide what system of heating could be best adapted to this particular group of buildings. To heat each building separately was not to be considered, as a power house was to be installed and this would not utilize the heat in the exhaust steam. If a high pressure steam system were installed, with reducing valves at each building, only a part of the exhaust steam could be used at best for heating the power house. As such an arrangement would mean so great a loss, it was eliminated from consideration. A low pressure system could make use of all the exhaust steam, but the first cost of mains and insulation was too great to be considered.

Hot water was then the only heating medium left. A one-pipe hot water system was compared with a two-pipe system for heating the group and the two-pipe system seemed better adapted for this installation. It was accordingly adopted. Its principal advantages over the one pipe system for heating buildings located near each other are the smaller branch mains, less radiator surface, lower friction head, and the fact that it may be given a greater reserve capacity for supplying future buildings.

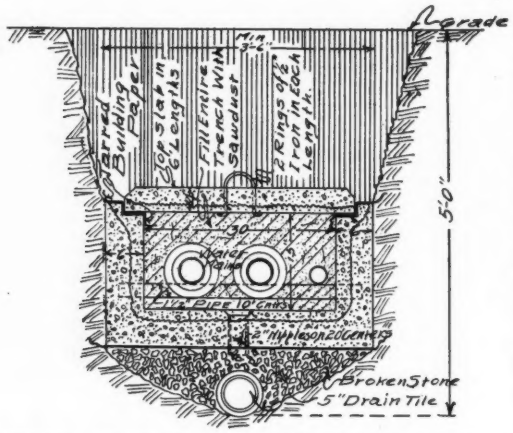
Smaller branch mains are possible with a two-pipe system because there is a greater differential pressure between the flow and return trunk main of the two-pipe system than there is between the two points where the branch mains are taken from the one trunk main, thus causing a greater velocity and, therefore, smaller mains with the two-pipe system. Should the one-pipe main be throttled to make this pressure and velocity equal to that of the two-pipe system the friction head would become prohibitive. It will readily be seen that the radiation will necessarily be larger with the one-pipe system, because the temperature of the water will be lower, due to its low velocity through the radiator and to the fact that the same water must pass through more than one radiator before being reheated.

A velocity of flow up to 12 ft. per second is maintained in one-pipe mains, since the cooled water from one building becomes in part the supply for the next. Hence the friction head is much greater in the one-pipe system. In this particular installation this additional friction head would be excessive, as the static head is so great that the friction head must be reduced to a minimum. The first cost of mains and conduits is less in a one-pipe installation and the radiation losses are less, but these points are overbalanced by the advantages of the two-pipe system.

Although most authorities recommend that the static head on the circulating pumps be kept as low as 100 ft., or 42 lbs., with a differential pressure of 25 to 30 lbs., the circulating pumps have a satic head of approximately 160 ft.



BASEMENT PLAN OF POWER HOUSE, SANATORIUM OF THE METROPOLIT AN LIFE INSURANCE COMPANY.



CROSS SECTION OF CONCRETE PIPE TRENCH TO COTTAGES.

or 64 lbs. Because of this head the differential pressure caused by friction has been reduced to 17 lbs., making the pressure on the discharge side of the pump 81 lbs. The glands and casings have been designed to withstand this pressure and, as the piping is good for a working pressure of 100 lbs., this pressure of 81 lbs. is considered safe, with a margin which will allow for an additional friction head, caused by the addition of radiation to the group of buildings.

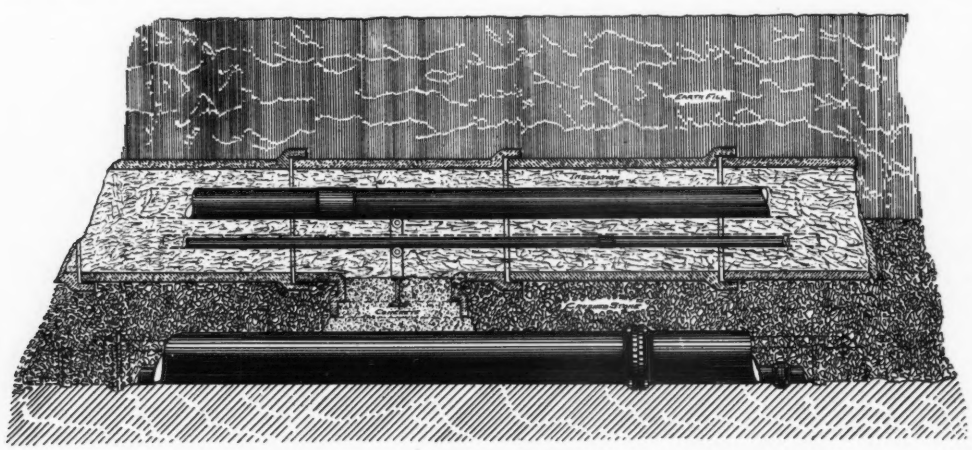
According to the original idea, a generating plant was to be installed with such a capacity that it could furnish light and power for the entire group. Later it was decided to take light and power from a local company. For this reason the power plant has not been installed, but, as the system was designed to work in connection with the power plant and as all connections and provisions have been made for its installation in the future, the power plant will be considered here as a part of the heating system.

With these points determined, the heating problem then evolved itself into determining the amount of radiation for heating the group of buildings by a two-pipe forced circulating hot water system, supplying medium pressure steam for the laundry, kitchen and other apparatus, heating hot water at the different buildings and utilizing the exhaust steam from the engines for heating the circulating. water.

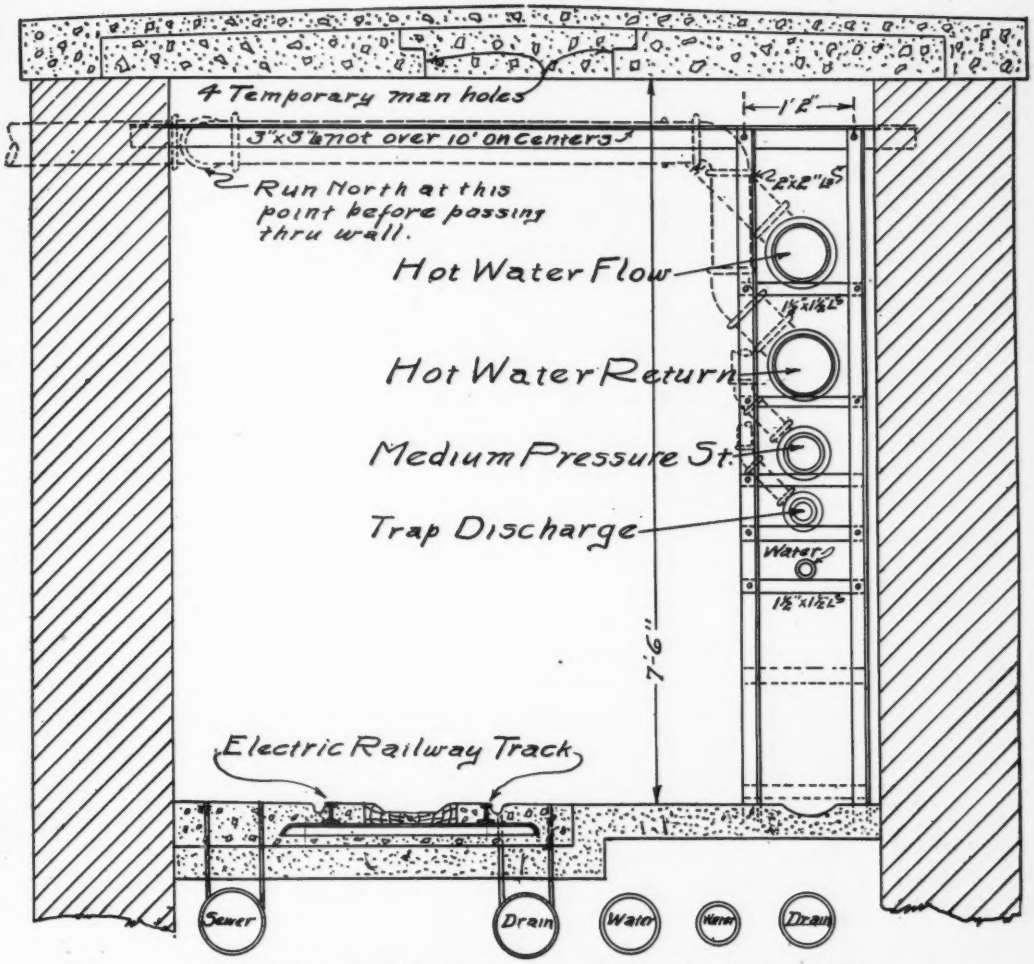
HOW THE RADIATION WAS FIGURED.

The radiation was determined in the usual way by taking the heat transmitted per hour by 1 sq. ft. of glass and wall per degree difference in temperature as 1 B. T. U. and 0.27 B. T. U., respectively. The cubical contents of the room were not taken into consideration in figuring the radiation, as the ceiling heights were never more than 12 ft.

The coldest weather at Mt. McGregor is –15° F. and an inside temperature of 70° F. was desired, so 85° was considered as the difference in outside and inside temperatures, except in special cases. The water entering the radiator was considered at 210° F. and the water leaving at 190° F., giving an average of 200° F. As 1 sq. ft. of radiating surface gives off 1.8 B. T. U. per hour per degree difference in temperature and as there is a difference of 130° F., the radiation from each square foot of radi-



LONGITUDINAL SECTIONAL OF PIPE TRENCH.



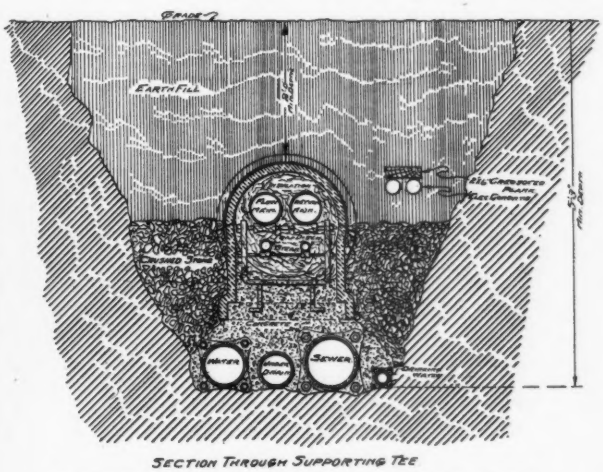
SECTIONAL THROUGH PIPE TUNNEL, LOOKING NORTH.

ator surface was considered to give off 234 B. T. U. per hour.

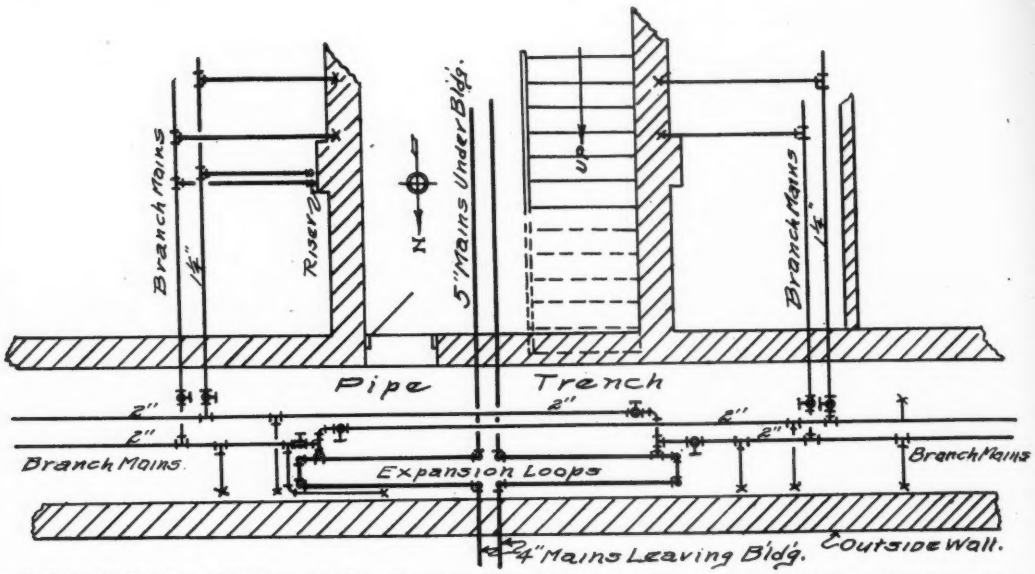
From the foregoing it was determined that each square foot of glass and wall would give off per hour 85 and 23 B. T. U., respectively, and, as each square foot of radiation emits 234 B. T. U., each square foot of exposed glass and wall required 0.37 sq. ft. and 0.1 sq. ft. of radiation, respectively, to supply the heat transmitted by them during the coldest weather. The above factors do not allow for the air leakage, so 45% was added, making the factor for glass 0.54 and for wall 0.14. These were used for southern exposures. Maximum allowances for other exposures were made as follows:

For north exposure, add 35%.
For west exposure, add 25%.
For east exposure, add 15%.

A factor of 0.12 was used for exposed roof and 0.06 for exposed ceiling. No allowance was made for the floor surfaces, as all floors are heated by the mains underneath.



SECTION THROUGH SUPPORTING PIPE TRENCH.



PIPE TRENCH UNDER WARD BUILDINGS NOS. 3 AND 4, SHOWING TYPICAL EXPANSION LOOPS AND CONNECTIONS.

Using these factors for the different exposures, the radiation required by the several buildings was determined to be as follows:

Each ward building.....	1364 sq. ft.
Refectory building.....	5540 sq. ft.
Power house	1309 sq. ft.
Infirmary building.....	2175 sq. ft.
Future administration building, approx.....	2000 sq. ft.
Total	19200 sq. ft.

Each square foot of radiation requires 234 B. T. U. per hour and, as each pound of circulating water gives 20 B. T. U. per hour, a square foot of radiating surface will require 12 lbs. of water per hour. The mains, branches, etc. will dissipate approximately 25% of the total radiation, so the water circulated per square foot of radiation will be approximately 14 lbs. per square foot of radiation. The 19,200 sq. ft. of radiation then requires 26,600 lbs. or 32,000 gal, of water per hour, equivalent to 533 gal. per minute.

(To be continued.)

Some Experiments on the Ventilation of a Schoolroom

A REVIEW OF THE WORK AND FUTURE PLANS OF THE CHICAGO VENTILATION COMMISSION.

By John Wilkes Shepherd.

Secretary of the Chicago Commission on Ventilation and Head of the Department of Science, Chicago Normal College.

(Read at the Fourth International Congress on School Hygiene, Buffalo, N. Y., August 25-30, 1913.)

THE best ventilation for a school building is that which most nearly duplicates outdoor ventilation. Our own experiences, together with the experience of past centuries, warrant our approval of outdoor air for breathing purposes.

It is much easier to commend outdoor ventilation than to point out the factors and conditions that produce it. Does the mere movement of air outdoors over an area in which one is at work or in repose, suffice for ventilation? Or does the rate of movement, or the change of rate, or the change in direction of the

movements, affect the results? Does the fact that most air movement is parallel with the earth's surface instead of vertical to it, make for better health conditions? How far is our opinion of outdoor ventilation influenced by the fact that one is usually in greater muscular activity outdoors than indoors? Finally, how can we discriminate between those outdoor agencies that produce good ventilation, and those outdoor agencies that also make for good health, for example, sunshine? These questions and other kindred ones become significant if we attempt to make indoor ventilation as good as outdoor ventilation.

Beyond doubt, our belief in outdoor ventilation dominates the practice in what, at present, we are calling open-air schools. Moreover, almost all are agreed that wherever feasible this type of schoolroom should come into general use. Personally I am thoroughly in spmpathy with the open-air school movement; however, I am convinced that in cold climates we must provide for closed schoolrooms. Instead of going outdoors in order to circumvent our difficulties in procuring proper ventilation, we must meet the issue squarely to the end that in cold weather we shall provide our closed schoolrooms with outdoor conditions of ventilation. The establishment of these conditions seems to me to be a problem for our generation.

MODERN BUILDING CONSTRUCTION REQUIRES MECHANICAL VENTILATING SYSTEMS.

Not longer ago than a generation or two, the ventilation of a schoolroom or building was of little concern. In those days we were unable to build as well as at present. In cold winter weather the windows rattled, and cold air swept under and above the doors, and sifted in around the windows. Through imperfections in construction, winds helped freely to ventilate all kinds of buildings. The methods of heating school buildings also were different from those in use at present. Stoves and open hearths were used in the earlier days. The combustion of fuel within the stoves or open hearths necessitated a change of air within a room or building. Moreover, this change of air was supplied from all parts of the room, which fact within itself meant also the ventilation of the room. In the days when heating was done entirely by fireplaces or stoves, a supply of fresh air was necessary for burning the fuel, and this was furnished through leakages of air around the poorly fitted windows and doors. To-day, as a rule, the fuel is not consumed within the schoolroom, and therefore there is not the constant demand for fresh air to enter the rooms for heating purposes; moreover, we now have devices to prevent leakage around windows and doors. In the ventilation of a school building today, therefore, we must purposely provide openings through which air enters the room, and also openings through which it leaves. And in addition to these openings, we must provide a means for forcing air *into, through* and *out* of the room.

Mechanical systems of ventilation have necessarily come into being, because of the improvement in the construction of buildings and the heating of rooms with other means than stoves and fireplaces. There are two general systems of mechanical ventilation, and all others are but modifications of one or both of these. The two systems are known by contrast as the plenum system and the vacuum system. In the operation of the plenum system, the air in the rooms is kept under a pressure somewhat greater than the atmospheric pressure outdoors, and therefore is more dense. In the operation of the vacuum system, the air within the rooms is somewhat less dense than that outdoors. Large fans are generally used in producing the increased pressure of the plenum system or the reduced pressure of the vacuum system. In both systems of ventilation, it is necessary to have a circuit through which air from outdoors is compelled to travel.

EQUIPMENT FOR PLENUM SYSTEM.

I shall briefly describe the plenum system because it is the one with which I began my experimental work. To begin with, it should be understod that the plenum system is both a ventilating system and a heating system, the idea being that a room is heated with air which subsequently is breathed by its occupants. The equipment for this system is substantial-

ly as follows: There is a central room at least as large as a schoolroom, which is known as the plenum chamber or distributing chamber, and from which air for ventilation and heating is distributed throughout the building. From this distributing chamber, inlet ducts lead to all the rooms in the building, and deliver the air into the rooms near the ceilings. All these rooms are also provided with outlet ducts near the floor line, and these ducts lead to air shafts connected with outdoors. Air is brought into the large central distributing room from outdoors, being drawn in and forced in by means of a large fan. The fan is installed between a large outdoor intake or screened opening, and the distributing chamber. Between the fan and the distributing chamber are banks of steam coils for the purpose of heating the air before it is delivered into the distributing chamber. In the latest improved plenum system, this central air chamber is divided into an upper and a lower portion, or compartments. The upper one of these compartments receives hot air, and the lower one temperate or cool air. The ducts that lead to the various rooms are connected both with the hot and cool air compartments of the distributing chamber. All ducts leading from the distributing chamber are provided with dampers by means of which the relative air supply for various rooms is controlled. The temperature of the mixed air delivered into the rooms from the two compartments, is under the automatic control of thermostats in the rooms.

The quantity of air delivered into the various rooms by the plenum system depends, most largely, on the area of the ducts and the speed of the fan. Roughly speaking, the idea in the plenum system of ventilation within a room, is that heated air distributed to the rooms at the ceiling gradually cools, and in doing so settles down into the breathing zone, and is then forced down to the floor and out by the fresh heated air that is constantly being forced in at the top of the room. This view seems satisfactory to most heating and ventilating engineers, and, therefore, the emphasis, in the ventilation of a building is placed by them on the quantity of air delivered by this system. In other words, ventilation, until very recently, had come to mean the delivery to and the removal from a room of a certain volume of air per unit of time.

The public school buildings of Chicago are equipped with the plenum system, and during the last three years I have made something of a study of and with this system. My study has been made within a building of rather recent construction, and, therefore, equipped with the latest ventilation devices. Just here may I say that I know of no better system of mechanical ventilation than that with which I began my study.

FIRST TESTS SHOW SUFFICIENT AIR QUANTITIES.

My first tests were made on the quantity of air delivered in unit time per pupil in a number of rooms in the main building of the Chicago Normal College. Anemometer readings showed a linear velocity of from 600 to 650 ft. per minute, which meant at least 30 cu. ft. of air per minute per pupil, counting forty as the number of pupils per room. From the tests made, it seems that a sufficient volume of air is delivered to and removed from our schoolrooms for adequate ventilation. There remains, however, a closely related question, namely, whether or not the air within the rooms acts as a unit, or whether, perhaps, there may be currents of air within the rooms.

USE OF TOY BALLOONS IN DISTRIBUTION TESTS.

I made a study for air currents in two rooms. One of these rooms is about 25 ft. square, with a 13-ft. ceiling, and contains one inlet duct and a single outlet duct. The other room is 26 by 45 ft. with a 13-ft. ceiling, and contains two inlet ducts and two outlet ducts. All four of these ducts are installed in the same wall, the inlet ducts above, and the outlet ducts near the floor. In all installations it is the practice to locate the inlet and outlet ducts on the same wall, so as most nearly to insure a circulation of air throughout the room. The tests on air currents were made under my supervision by a class of manual-training students (boys) who were graduates of technical high schools, and the work was done as part of a required course.

Two devices were used in making the tests. Toy balloons were inflated with hydrogen gas and counterpoised in the rooms by means of improvised weights. Small turbine wheels, also, were used. These were made from aluminum, cork and steel needles, and were especially constructd for these tests. The blades of the turbines were made from aluminum and set into hubs of cork. Across one end of a cork hub and parallel with the plane of the blades, was fastened a strip of aluminum containing a slight indentation in which the pivot of the device turned. The fine point of a steel needle served as a pivot, and when ready for use the turbine revolved in a horizontal plane. These turbines were very sensitive to vertical currents of air; in fact, they responded to convection currents from the heat of one's hand. The counterpoised balloons were useful in tracing all air currents, irrespective of their direction, whereas the turbine wheels could be used only in testing for vertical currents.

I shall now speak of the tests within the two rooms heretofore mentioned. The smaller room, 25 by 25 ft.. has an east exposure. The other walls of the room have no immediate contact with the outdoors. The inlet and outlet ducts in this room are installed in the north wall, and the air enters the room with a velocity of about 650 ft. per minute. When balloons were pushed into the entering current, they were hurried across the room near the ceiling to the south wall. From the ceiling at the south wall the balloons usually took one of two general courses, depending largely upon outdoor weather conditions. If the outdoor temperature was low and the wind was blowing directly against the windows, then the balloons moved over to the outside wall, down the wall or windows, and over to the outlet duct. If the outside temperature was moderate, then instead of the balloons crossing over to the outside wall, they were likely to poise in the southeast corner of the room, or possibly move vertically down along the wall opposite the inlet duct to within a foot or two of the floor, and then over to the outlet duct. It was very noticeable that air currents established themselves in aisles and other open spaces along the floor.

During the winter season the turbine wheels, when placed on the window ledges, revolved almost all the time. Their direction of rotation indicated the downward movement of a sheet of cold air; moreover, this sheet of cold air was very perceptible to any one seated near the outside wall or windows. It might be said here that in planning an installation, it is the practice to have the hot air delivered across the room to the outside wall, in order partially to overcome the influence of wall and window chill. This plan of installation could not be carried out in the room just mentioned.

CONTROL OF AIR CURRENTS WHAT MAKES VENTILATION DIFFICULT.

The larger of the two rooms, 26 by 45 ft., is a northwest corner room. It has about twice as much exposure on the north as on the west side. As already stated, there are two inlets and two outlets in this room, and they are located in the long inside wall. The velocity of the incoming current of air was practically the same as in the smaller room. Anemometer readings showed an adequate supply of air for good ventilation.

Balloons placed in the incoming current were hurried across the room to the opposite wall, the outside wall with the north exposure. After reaching the outside wall, they almost always went vertically downward to within a foot or two of the floor; then they moved over to the outlets near the floor and almost directly under the inlets. The hot incoming air driven against the cold outside north wall and windows, reduced the influence of wall and window chill. But in cold weather, especially with a north or northwest wind a downward moving sheet of cold air was very noticeable.

The small turbine wheels revolved constantly in cold weather when placed upon the window ledges or near the exposed walls. In the central part of the room, that is, between the two sets of inlet and outlet ducts, the balloons did not show perceptible air currents. Furthermore, there seemed to be eddies in close proximity to the currnts at either end of the room. From the evidence obtained in the use of the balloons and turbine wheels, I concluded that air within our school-

rooms did not act as anticipated in the plenum system. My experiences throughout my experiments have convinced me of a rather paradoxical view, namely, that the thing which makes mechanical ventilation possible is also the thing which makes it difficult to obtain. I refer to the fact that currents are very easily established in atmospheric air, and it is the control of these currents that makes ventilation difficult.

TESTS WITH INDIVIDUAL SUPPLY OF AIR.

My first constructive effort in the ventilation of a school room in which the plenum system had been installed, was an attempt to supply each pupil with his portion of the fresh air admitted to the room. I wanted first to deliver the air into the room near the pupils and, secondly, to take advantage of convection currents produced by the pupils.

One of the regular schoolrooms of the Normal College was set apart as an experimental room. This room is 24 by 32 ft., on the basement floor, and has a west exposure. The room had a 13-ft. ceiling. In the original installation for ventilation, air entered the room near the ceiling at the center of the east wall. The main air current was across the room from the east wall to the west (outside) wall, then down the cold outside wall, and back to the outlet duct near the floor in the east wall.

The changes made in the room were as follows: First, the outlet duct, near the floor, was closed; then an air-tight false floor was built about 18 ins. above the regular floor of the room, and a false ceiling was hung about 8 ins. below the room ceiling; then an air shaft was constructed to connect the inlet duct of the original installation with the air reservoir between the floors. The outlet duct was tapped near the ceiling connecting it with the compartment between the ceiling and the false ceiling.

Three-inch circular holes were cut through the false floor, and galvanized iron pipes, fitted into these openings, led under each desk to within an inch of the desk bottom. Openings also were made through the false ceiling so that air delivered into the room might move on through it.

It will be noted that these changes turned the operation of the plenum system upside down. Instead of the air entering at the ceiling and leaving near the floor line, this new scheme delivered the air below the floor, and outgoing currents left the room at the ceiling. As already intimated, the idea in this scheme was to furnish a positive distribution of air to all the pupils within a room, and also to take advantage of the heat liberated by them in the production of upward moving currents.

The new installation was tested in two ways:

(1) Simple tests were made with anemometers placed at the edges of the desks. Every test showed an up current.

CHEMICAL TESTS WITH AMMONIA.

(2) A more striking test than the one with the anemometer, and one as fully convincing, or even more so, was a chemical test made with ammonia and an indicator known as phenolphthalein. This chemical test was made as follows: Linen strings were stretched over the rows of desks at the height of the breathing zone for children seated at the desks. Upon these strings, at intervals of ten or twelve inches, were hung pieces of unsized paper made wet with an alcoholic solution of phenolphthalein. When the room was thus dotted over with these wet papers, it looked much like a laundry drying room flecked with white. Before the wet papers had time to dry, a handkerchief, made thoroughly wet with concentrated ammonia water, was hung in the air duct leading from the plenum chamber, or distributing room, to the experimental room.

Within two minutes after hanging the handkerchief in the duct, every paper on the linen threads in the experimental room became red in color. When ammonia is added to a colorless solution of phenolphthalein, the solution becomes red; therefore, the change in the color of the papers was conclusive evidence that ammonia from the handkerchief had been distributed to every piece of paper wet with the alcoholic solution. The test was repeated at another time with the same result.

Still another test was made which contained an added feature. In addition to the papers suspended in the breathing zone over the desks and seats, others

were hung on strings stretched parallel with those over the rows of desks about 7 ft. from the floor, but directly over the aisles. In this test all the lower papers reddened in approximately the same time as before, and the upper ones reddened soon thereafter. These tests are conclusive evidence that the air in the experimental room is delivered to each desk, and that the movement of the air in the room is upward, and quite uniformly so. Moreover, anemometer tests made at the outlets of the galvanized iron tubes before the desks were placed, showed that each tube delivers approximately the same volume of air in unit time.

As soon as the before-mentioned changes in the experimental room had been made and tested, the room became a regular high-school room, in use throughout the day. In our high school, it is customary for classes to change rooms for different recitations, and therefore the experimental room was occupied by different classes each hour. This arrangement added somewhat to the difficulty of our experiments.

SOURCE OF CONTAMINATION IN RESPIRED AIR.

As soon as the pupils became accustomed to the room, tests were made to determine the degree of contamination of the air within the room. The amount of contamination due to expired air was determined by chemical tests for carbon dioxide as an indicator. A large number of such tests were made. The director of the Municipal Laboratory of Chicago and one of his chemists helped to make the tests. Samples of air were taken from the breathing zone of the different classes, and the amount of contamination was always well within the limit of safety. This limit generally considered as one-tenth of 1%.

It is generally considered that the percentage of carbon dioxide in an occupied room is only an index of the harmful agencies present, and that the carbon dioxide itself is comparatively harmless. I am of the opinion that the injury resulting to an individual from breathing expired air, is due in the largest degree to inhaling air expired by others, and not from that expired by himself. The reason for this opinion is that exhaled air comes from an organism in which healthy tissues function normally in their own more or less toxic surroundings. Except for the impurities already in the air supplied for breathing purposes, exhaled air can contain only those things which were present in the exhaling organism, and also in greater dilution than in the organism itself. Experiments have shown that under certain conditions one may live comfortably in an atmosphere highly contaminated with expired air when the contamination is due only to the respiration of the individual himself.

If my belief is well founded that the greatest injury from breathing respired air comes from cross-contamination, then it is highly significant to note that the installation in the experimental room is such as to minimize the possibility of pupils breathing air that has been breathed by others. This is due to the fact that the air is delivered under each desk and then is moved upward to the ceiling instead of being blown across the room or of depending on diffusion or convection.

IMMEDIATE PHYSICAL COMFORT A REQUIREMENT FOR VENTILATION.

However satisfactory the quantity of air furnished for the ventilation of a room, and however satisfactory may be the means employed for properly distributing it, both of which in the long run are very important, nevertheless the human body makes an immediate demand which may overshadow either or both. *Immediate physical comfort is the standard of the human body,* whatever the consequences, as exemplified either in the drowsy stupor that descends on one immersed in a hot, stifling atmosphere on a cold wintry night, or in the quiet repose that comes from a balmy summer breeze outdoors. I want to insist that good ventilation shall produce immediate comfort.

One of the most prominent as well as immediate factors in the production of comfort is temperature, and therefore a study was made to determine the best temperature for a schoolroom. The comfort of the human body is largely influenced by the temperature of the surrounding air, and also, and at the same time, by the rate at which perspiration may evaporate into the air from the body. Relative humidity influences the rate at

which such evaporation occurs, but it is only in recent years that much consideration has been given to atmospheric humidity in relation to temperature and comfort.

TEMPERATURE AND HUMIDITY IN RELATION TO COMFORT.

It has become traditional in this country that the best temperature to maintain in a room is 68° to 70° F. There are, however, some who urge that these temperatures are too high, and they cite the English practice of 59° to 62° F. as evidence of their claim. The difficulty with both these positions is that in deciding on the best temperature proper, consideration is not given to relative humidity. Any adult knows that sultry days are much less comfortable than days of even higher temperature when the atmosphere is comparatively dry. This well-known fact of outdoor experience must be taken into account, especially since it is now recognized that in cold weather we need to humidify air indoors. On this point of humidity may I say that the human organism seems to be adapted to a large range of relative humidity, but it is not accustomed to abrupt changes such as one might experience on a cold day in passing from the outdoors into a heated room. In a word, it seems important from the standpoint of health and comfort to maintain a fair degree of correspondence between the relative humidity of outdoors and indoors.

I want to insist that any system of ventilation, to be practicable, must produce a feeling of comfort, and therefore both the temperature and the relative humidity of the air are important in ventilation. Temperature and relative humidity jointly help to determine comfort.

It has generally been considered that a temperature of from 68° to 70° F. with a relative humidity of 70%, is a most desirable condition to obtain (the 70% relative humidity also is largely traditional). In our tests it was assumed that the best temperature may or may not be 68° to 70° F.; and also the most satisfactory relative humidity may or may not be 70%.

Our experimental room was equipped with an automatic temperature control, and also an automatic humidity control. Moreover, the temperature in the different parts of the room was determined by standard thermometers, and the relative humidity in the different parts of the room was determined by means of a sling psychrometer. For the most part, the tests on relative humidity and temperature in relation to comfort, were made by hyself and a graduate student from the University of Chicago. Frequently individual high-school pupils in the room were asked whether or not they felt comfortable, and in each case the pupil answering did not know that any other pupil had been asked. The teachers in charge of the room also were asked for opinions. All these opinions together with our own served as a basis for record.

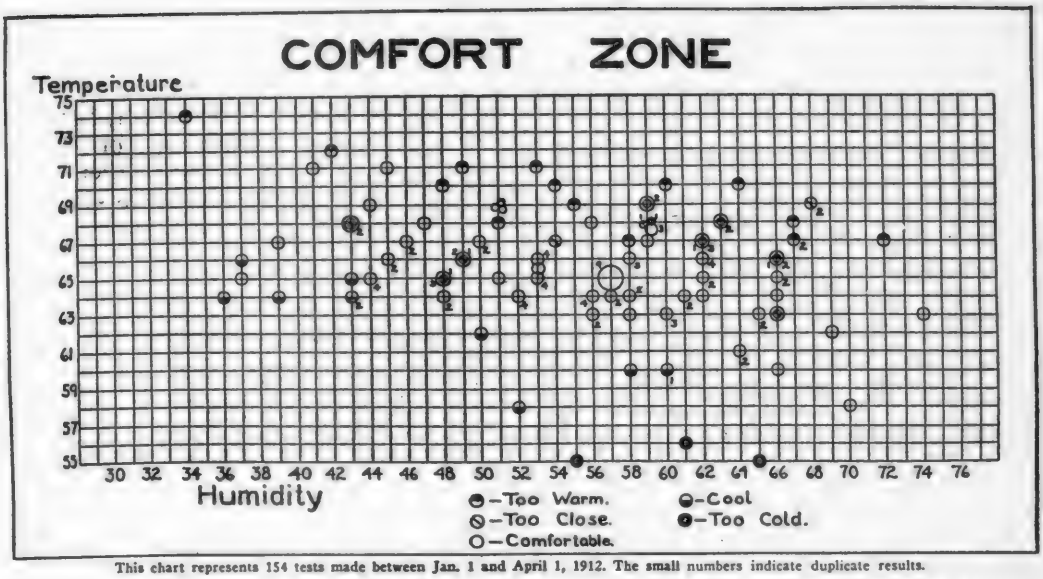
ESTABLISHMENT OF A COMFORT ZONE.

Before working very long, it became evident that there was a temperature and humidity range within which the occupants of the rooms were comfortable, and this range gave rise to what I have called the Comfort Zone. This term, comfort zone, means that there is a maximum temperature with a minimum relative humidity, and a minimum temperature with a corresponding relative maximum humidity between which limits the occupants of a room are comfortable. In other words, there seems to be no best temperature and also no best relative humidity; but the maximum temperature at which one is comfortable will be associated with a minimum relative humidity, and the minimum temperature for comfort will have associated with it a maximum relative humidity. Under the conditions with which we were working, we found that a teperature of 64° to 70° F., with a corresponding relative humidity of 55 to 30%, seems to be the limits; that is, the comfort zone for us was between 64° and 55% and 70° F. and 30%.

It is worthy of note that with a temperature below 67° or 68° F. with a proper relative humidity, the pupils were better able to give attention to their work than if the conditions were otherwise.

CLEAN AIR FOR VENTILATION.

In the ventilation of a school room, one should give careful consideration to the source of air supply and also to dust from the floor. The reason for this is



This chart represents 154 tests made between Jan. 1 and April 1, 1912. The small numbers indicate duplicate results.

CHART SHOWING TEMPERATURE AND HUMIDITY RANGE WITHIN WHICH OCCUPANTS OF ROOMS WERE COMFORTABLE.

obvious. Late in the autumn of 1911, some experiments were undertaken to determine to what extent the air for ventilation in the experimental room was contaminated with dust from the floor. It was thought that air blown close under the desks probably would baffle the dust stirred up from the floor. The experiments done at that time were too few in number to warrant a conclusion, but it is the intention during the coming autumn and winter to complete the tests. The tests will be made, as were the earlier ones, from bacterial growth on exposed culture plates.

OUTSIDE WALL AND WINDOW CHILL.

The problem of how to prevent outside wall and window chill from seriously interfering with ventilation, has never been satisfactorily solved.

With the change in installation in the experimental room, it was necessary to make some provision for preventing a sheet of cold air from falling down the exposed walls and windows. We tried to do this by installing steam pipes along the window casings just in front of the windows. The idea in this installation was to induce convection currents around the windows, and in this way prevent the downward currents of cold air. Tests were made of the scheme in two ways:

(1) By the use of the small turbines it was found that down currents of air were established from a few inches to a foot or more above the horizontal steam pipes.

(2) A second method was that of getting temperature readings at different heights from the floor in the aisle between the desks and the outside wall. These temperature readings showed a variation from almost nothing to 8 to 10° F., between the floor and the top of the desks.

During the very severe weather of January and February, 1912, it became evident that this installation was only partially satisfactory. When the outside temperature was 10° or more below zero, there was a cold current of air that spilled out from the window over the top of the heating pipes above the window sills. This fact led to a proposed installation to overcome the window chill in another way—by means of a sheet of hot air. This new installation will be tried during the coming winter.

THE HUMIDITY FACTOR A SERIOUS ONE FOR THE PLENUM SYSTEM.

As already stated, the plenum system combines the heating and the ventilating of a building. The heating is accomplished by means of heated air which subsequently is used for ventilation.

My experimental work has determined that the amount of air necessary for heating a building in cold weather, is greater in quantity than that necessary for ven-

tilating. This fact becomes significant when the relative humidity is taken into account. In order to increase the relative humidity within a room, it is necessary to evaporate water into the air. Whatever the source of this moisture, it entails expenditure of energy which, of course, costs money; and since it is best in our climate to have a fairly humid atmosphere in which to live, it becomes a question of considerable importance from the standpoint of economy as to whether or not it is best to allow the heating and ventilating of a building to remain combined. Air need not be humidified for heating purposes.

Aside from the standpoint of cost, there is also involved the debatable question of whether or not one should breathe air soon after it has been heated as hot as is necessary when used in the plenum system. Physicians are not agreed upon the point; and, therefore, it seems desirable to avoid it, especially when it may be avoided without additional cost, probably at a less cost.

AIR WASHING AND RELATIVE HUMIDITY.

Wherever foul air only is available for ventilation, the very important and vital matter of air-washing may readily take care of adding humidity to the air. I have done nothing on the problem of air-washing.

OUR NEXT MOVE.

We now propose to separate the heating of our experimental room from the ventilating in so far as they seem to impair the efficiency of each other. The scheme in brief is this: We propose to heat the room by means of hot air circulated under the floor, some of which will be allowed to escape through proper openings under control along the outside wall and windows, and thus force a thin sheet of hot air vertically upward. This thin sheet of hot air is for the purpose of destroying outside wall and window chill.

The ducts for ventilating the room will remain substantially as they now are except that the supply of air for breathing will be independent of that for heating; undoubtedly this will mean a lower temperature of the air for breathing purposes, and also will necessitate a minimum of moisture for properly humidifying the air for breathing.

The experimental room is now being fitted out in order to make tests along the line just indicated, during the coming winter.

I wish now to acknowledge my indebtedness to the Board of Education of the City of Chicago; the Department of Health, City of Chicago; also to the other members of the Chicago Commission on Ventilation. Without assistance from these various sources, I could not have carried out my experiments.

Finally, the idea toward which all my experimental work is directed is that of keeping the schoolroom sufficiently warm to be comfortable to its occupants, and at the same time furnish them, for breathing purposes, with an individual and adequate supply of fresh, clean, cool, humid, moving air from outdoors.

New Books.

THE THEORY AND PRACTICE OF HEATING AND VENTILATION, by A. H. Barker, one of the most voluminous works on the subject that has been published, has lately made its appearance. It is a volume of 732 pages, the book itself measuring 7¾x10¼ in. Every phase of the subject is discussed, from the properties of matter, motion and energy to combustion of fuel and the testing of plants for heating and ventilation. Methods of producing circulation in systems of water pipes, distribution of heat by steam at high pressure, heating by steam in a closed system of piping, are other sub-divisions of the book that come in for exhaustive discussion, with charts and other illustrations. In short, the volume is described as a detailed explanation of the application of scientific principles to the chief problems with which the heating engineer has to deal. Price $8.00. Sold by D. Van Nostrand Co., New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

ARCHITECTS' DIRECTORY AND SPECIFICATION INDEX FOR 1913-1914, has been published by the Wm. T. Comstock Co., 23 Warren St., New York, being the tenth edition of this work. The directory section has been carefully revised, and in addition to containing a complete list of architects of the United States, Canada, Cuba and Mexico, classified by States and town, together with architectural societies, etc., it includes a specification index of prominent dealers and manufacturers of building materials and appliances. The directory, which contains some 200 pages, is sold at $3.00, and may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

Meter Rate Versus Flat Rate for Steam Heating Service

By H. R. Wetherell,

Superintendent Steam Heating Department, Central Illinois Light Co.

Many managers of electric companies who operate a heating system in connection with their electric plant, are of the opinion that there is no money in the heating business, but that it is a necessity which enables them to obtain electric contracts which they would be unable to secure if it were not possible to supply steam to those customers.

The writer thoroughly agrees with them on that particular point, providing the heating department is forgotten and is left to run itself, as it is in a great many cases. However, if the heating department is put under the supervision of a competent heating man and is given the same attention that the electric department receives, there is no reason why it should not pay a fair interest on the investment; that is, of course, considering that the rates are adequate to cover the service which is required.

The great trouble with the majority of the heating companies is that they are operating under a flat rate system of charges. There is no reason why steam should be sold by flat rate any more than water, gas or electric current should be sold in that manner.

Most of the electric plants in the smaller towns were originally operated on the flat rate system of charging, but it has been found necessary in most of these plans to change over to a meter rate in order to make a fair profit.

It has been demonstrated that it is much easier to waste steam, than it is to waste either electric current or water. For instance, if the customer sees his electric lights burning he knows he is using the current, or if he sees the water running from the faucets that he is using the water. But there is not one customer out of twenty-five who knows that when he has the radiator turned on and the windows open, on a day when the temperature out-of-doors is about 40° F. above zero, that the radiators are condensing more steam than they would on a day when the out-of-doors temperature is zero and he has the windows closed.

There have been cases where, by covering exposed pipes in the basement and repairing windows and doors in same, a customer has been able to cut his bills in two. It has also been proved that by installing weather strips on the doors and windows of a building, the bills have been cut from 20% to 25%, and by shutting off the service valve at night and Sundays, in business buildings during the months of October, November, April and May, when the out-door temperature is above 30° F., the bills for those months were reduced 40%.

The following figures are taken from the reports for three seasons, from a company which operates under both a meter and flat rate charge.

You will note that the flat rate customers use from 70% to 80% more steam per square feet of radiation than the meter rate customer. In fact, the detailed reports for the same periods show that some of the flat-rate customers condense as high as 1,500 to 2,000 lbs. of steam per season, and several as high as 2,500 lbs. of steam per season per square feet of radiation connected. It also shows where meter-rate customers have run as low as 240 to 300 lbs. of steam per season per square feet of radiation connected.

The writer wishes to show with the following figures, how it is possible to condense more steam in a radiator placed in a room with the windows open, on a day that the out-door temperature is 40° F. above zero than it is on a day that the out-door temperature is zero and the window is closed.

The above tests were made in a small office with a 60 sq. ft. radiator, which stood in the corner of the room about 2 ft. from the window.

If the radiator had been located directly under the window the rate of condensation on the test, with the window

TABLE SHOWING COMPARATIVE PROFITS FROM METER AND FLAT RATE SERVICE FOR THREE SEASONS.

	Cubical Contents, Sq. Ft.	Direct Radiation, Sq. Ft.	Condensation. Thousand Pounds, Condensed.	Condensation. Per Sq. Ft. Radiation, Lbs.	Condensation. Per Thousand Cu. Ft. Lbs.	Net Revenue. Per Sq. Ft. Radiation.	Net Revenue. Per Thousand Lbs. Condensed.
Season 1910-1911.							
Flat Rate..	9,059,034	85,648	83,274	972	9,192	$0.277	$0.285
Meter Rate.	5,733,293	54,277	28,347	522	4,944	0.233	0.447
***Season* 1911-12.**							
Flat Rate..	10,197,046	85,689	101,549	1,185	9,958	$0.285	$0.240
Meter Rate.	7,913,229	71,908	50,334	699	6,360	0.295	0.422
Season 1912-13.							
Flat Rate..	10,599,421	101,645	101,049	994	9,534	$0.284	$0.286
Meter Rate.	8,798,988	90,388	51,526	570	5,856	0.248	0.436

open, would have probably been higher.

ANOTHER COMPARISON OF METER AND FLAT RATE SERVICE.

The following figures give the monthly steam consumption of two district heating systems, one of which is operating under a straight meter rate and the other under a combination meter and flat rate.

Company A is located in a city with a population of about 95,000 and has about 362,300 sq. ft. of radiation connected to its mains, of which about 65 per cent is flat rate and 35 per cent is sold by meter. The interior piping, in most of the buildings connected to this system, has been

No. Hrs.	Outside Temp. Deg. F.	Inside Temp. Deg. F.	Condensation. Lbs.	Lbs. Per Hr. Cond.	Lbs. Per Sq. ft. Rad., Cond. Per Hr.
Test With the Window Closed.					
6	20	75	43.5	7.2	.12
5	20	75	34.	6.8	.113
3	8	74	24.	8.	.133
Test With Windows Open.					
3	35	70	36.	12	.200

	Company A Condensation per Month, in Pounds per Square Foot of Radiation, Season 1912-13	*Company B* Condensation per Month in Pounds per Square Foot of Radiation, Season 1912-13
October	52.4	42.0
November	88.3	65.2
December	128.5	100.4
January	145.7	117.7
February	159.9	120.3
March	131.4	94.3
April	102.1	56.5
May	33.6	16.9
Total	841.9	613.3

installed under the company's supervision and is in first class shape.

Company B is located in a city with a population of about 10,000 and has 60,600 sq. ft. of radiation connected to its mains. This company has been in operation since 1902 on a flat-rate basis, and was operated at a loss until last season, when it was changed over to the straight meter rate of charging. The accompanying figures shown of this company were taken from last season's readings.

The rate of condensation of Company B, for the season of 1913-14 will probably be 15 per cent to 20 per cent lower than for the past season, as most of the customers are now convinced that it pays to regulate their service. It took the customers half of last season to realize this fact, after having been on a flat rate for ten years and using as much as they pleased.

In conclusion the writer would recommend to the heating companies who are operating their heating department at a loss:

That they put the heating department under the supervision of a competent steam heating man.

That they give him the full charge and the necessary clerks so that he can compile a complete system of records and data necessary to operate his department.

That they pay more attention to the installation of the interior piping in the customer's premises to see that it is installed in the proper manner.

That steam be sold by meter rate, if possible, rather than flat rate.

Purification of Air and Water by Means of Ozone

RECENT TESTS IN NEW YORK SCHOOL ROOMS.

BY J. C. OLSEN,

Professor of Analytical Chemistry, Polytechnic Institute, Brooklyn, N. Y.

(Read at the Fourth International Congress on School Hygiene, Buffalo, N. Y., August 25-30, 1913.)

EDITOR'S NOTE.—In a letter accompanying his manuscript, Prof. Olsen writes: "I am quite enthusiastic about the future of ozone in connection with the purification of air and believe that great advances will be made in this respect in the near future, especially as the ozone machines have been very much perfected and very successful machines are now being manufactured for commercial use. There has been considerable discussion as to the possible harmful effect of ozone on those who breathe it, and the statement has been made that the concentration of ozone required to destroy pathogenic bacteria is altogether too high for breathing purposes without injury. I have not been able to find any authoritative verification of this statement, and as you will notice, I suggest in the paper that experiments should be made extending over a considerable period in school rooms or other suitable places where careful observation can be made of the conditions of health of those who breathe ozonized air and compared with similar groups who do not breathe this air. I believe that until such experiments are made, we cannot consider this point settled. The general observation of those who have used ozone in offices in New York and elsewhere is that the time lost by employees from sickness is very much reduced. If it should be found that a sufficiently high concentration of ozone cannot be employed in single rooms and public places when people are present, I still believe that a great advance will be made if such rooms were regularly sterilized by means of ozone immediately after such rooms have been vacated, and that a low concentration of ozone would materially decrease the danger of infection. The same ozone machine can be adapted for purifying both the water and the air; a supply of ozonized sterile water being prepared when the ozonizer is not in use for purifying air."

Undoubtedly, the death rate from contagious diseases could be greatly reduced if we had at hand means for sterilizing or purifying the air as it passes from one

individaul to others, as well as the clothing and furniture in our living rooms. Our places of public assembly, such as theatres, churches, public halls and schools are, undoubtedly, great clearing houses where the germs of contagious diseases are distributed to be carried by susceptible individuals into our home. An interesting study could, no doubt, be made of the number of cases of diseases of a contagious nature occurring in a group of school children meeting in school rooms in which the air is ozonized and compared with the number occurring in school rooms in which the air is not ozonized.

Mr. George C. Whipple has made a very interesting study of the value of pure water to a community. From the reduction in the death rate from typhoid fever and other water-borne diseases on changing from a somewhat polluted to a pure water supply, he concludes that the pure water is worth to the community from $66.71 to $121.77 per million gallons consumed, depending upon the consumption per capita.

The value of ozonized air could be computed in a similar manner from the aggregate doctors' and nurses' bills as well as the value of the lives of those whose deaths are due to impure air. According to the table used by Mr. Whipple, an average child of 5-10 years is worth $2,300, while a child 10-15 years is worth $2,500. The aggregate would, undoubtedly, be very considerable and many times greater than the cost of ozonizing the air, which is quite small. Of course, this is considering the question from the financial point of view only. Other considerations will suggest themselves to every one. Observation in offices where the air is ozonized has shown a marked reduction of the time lost by the clerical force on account of sickness.

Chemically we find that chlorine is a strong oxidizing agent while sulphur dioxide is a strong reducing agent. This is also true of formaldehyde. The natural disinfectant which continually operates is the oxygen of the air. This is particularly efficient in the presence of strong sunlight, the actinic or chemical rays of which greatly accelerate the action of the oxygen of the air. Natural waters are purified in this manner. The amount of dissolved free oxygen is now considered the best criterion of the purity of water as pathogenic bacteria cannot long survive in its presence.

Ozone is a modified form of oxygen produced by passing the silent electric discharge through oxygen or the air. The oxygen absorbs energy from the electric current and passes into an allotropic modification which is more active than ordinary oxygen. This increased activity of ozone is due to the energy which it contains. Chemically it is given the formula O_3, while ordinary oxygen has the formula O_2. When ozone comes into contact with dead organic matter or living organic matter, such as bacteria, oxidation immediately takes place with destruction of the organic matter or bacteria. Ozone is more efficient in this respect than oxygen so that, while some pathogenic bacteria can resist the action of oxygen, it has been conclusively demonstrated that pathogenic bacteria are quickly destroyed by means of ozone. When present in suitable concentration ozone has long been recognized as beneficial to human beings whose vigor and very life depend upon oxidizing processes. There is always present in the mouth and nasal passages a great deal of effete organic matter and bacteria which can be ozonized with great benefit to the organism. Ozone is not in any way destructive of clothing or furniture, but on the contrary very quickly and effectively removes any disagreeable odors which may be present. Plant life is not injured by ozone. When breathed in too great concentration, irritation of the throat and nasal passages result, but no permanent ill effect results. For breathing purposes not more than 0.3 parts of ozone per 1,000,000 parts air should be present.

OZONE TESTS IN NEW YORK SCHOOL ROOMS.

On June 23 a test was made in New York City of the air in school rooms before and after ozone has been introduced. The test was carried out by the Board of Education and a representative of the Board of Health having been arranged for by the American Museum of Safety of New York. The first test

was made in a room 20½ x 22½ ft. with 12 ft. ceiling. It was situated on the ground floor, with three windows opening directly upon the street. The temperature of the room was 25° C. The pupils were of Grade 1A and numbered 44.

All determinations were made by drawing 3 cu. ft. of air through a sterilized tube containing sterilized sand. The sand was afterwards washed with 10 c. c. of sterile water which was plated on agar agar, incubated at 37½° C. and counted after three days, and on gelatine, incubated at 20° C. and counted after 14 days. Moulds were also counted. Tests for B. Coli were also made by means of ox bile.

The following tests were made without ozone:

Sample of air taken at 11.45 A. M. School in session—teacher and six adults present. Windows open.

Total bacteria per cut ft.....167
Moulds per cu. ft..... 23
B. Coli.....absent

Test made at 12 M. School marching out.

Total bacteria per cut ft.....533
Moulds per cu. ft..... 30
B. Coli.....absent

These tests show the condition of the air in the room with the school in session and marching out.

A further test was made when only the adults who were taking the samples were present. The fan of the ozonizing machine was going but no ozone was generated.

Windows closed, fan going, six adults in the room. Sample taken at 12.30.

Total bacteria per cu. ft. 133
Moulds per cu. ft..... 67
B. Coli.....absent

Finally the ozonizer was operated for 15 minutes and a strong smell of ozone was noticeable throughout the room.

Sample take at 1 P. M.

Total bacteria per cu. ft..... 7
Moulds per cu. ft..... 10
B. Coli.....absent

The reduction in the number of bacteria is so great that all disease bacteria were probably killed and the air rendered entirely safe if experience with water-borne bacteria can be used as a guide.

Experiments were also conducted in another school building in the same crowded section of Manhattan. The room selected was in the old portion of the building and measured 15 x 19 ft., with a 14 ft. ceiling. The grade was 2A with 31 pupils. There were two windows on one side of the room which were open from the top.

The samples were taken and counts made in the same manner as already described.

School in session. Fan going for 15 minutes. Sample taken at 2.42 P. M.

Total bacteria per cu. ft.....133
Moulds per cu. ft..... 17
B. Coli.....absent

The fan only of the ozonizer was operated during this test. After the ozonizer has been operated for 15 minutes, another test was made.

School in session. Ozonizer operated for 15 minutes. Sample taken at 3.10 P. M.

Total bacteria per cu. ft..... 33
Moulds per cu. ft..... 7
B. Coli.....absent

The reduction in the number of bacteria was not as great as in the tests in the first school, probably because the windows were open from the top, allowing constant entrance of bacteria-laden air. The number of moulds is also not so great, as the room was on the second floor and on the south side of the building.

The ozonizer was continued in operation during the dismissal of the school and after 15 minutes another test was made with the following result:

Total bacteria per cu. ft..... 7
Moulds per cu. ft..... 7
B. Coli.....absent

While the movement of the pupils would tend to increase the number of bacteria in the air, the continued action of the ozone reduced the number of bacteria so that the air was finally as nearly sterile as in the first room tested. Undoubtedly, the ozone tends to sterilize the clothing and the dust on the floor and furniture so that while movements of the pupils may increase the amount of dust in the air, the bacterial content of the air is decreased.

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FROM numerous sources recently the cry for the open window, especially in school ventilation, has come with increasing persistency. Thoughtful men have allowed themselves to be carried away by the apparent logic of the situation and see no other alternative. The mere fact that their line of reasoning is based on the recent pronouncements of physiologists and others regarding past and present methods gives them additional assurance in their conclusions.

There is no disputing the fact that the investigations of the year in this direction have served to becloud as much as to clarify the problem. But that fact furnishes all the more reason why conclusions should not be reached hastily. Here, for instance, is one writer saying: "What more practical activity for anti-tubercular societies that a campaign for open window schoolrooms? These fortify children against disease and teach parents through the children the value of fresh air in living rooms and sleeping rooms." Now it is well recognized that the most advanced advocates of open window schools realize the need of at least a partial heating of the rooms. This alone makes the issue perfectly clear. It is not a question of housing children in uniformly cold rooms, but one of subjecting them to variations of temperature that may be both violent and rapid. This, in the opinion of those best qualified to judge, is a condition that will never be allowed to prevail for any length of time, due to the disastrous results which must follow such a course.

While some of the recent investigators have expressed their convictions that the open window is the sole solution of the matter, the weight of opinion can readily be shown to be against such a practice, even among the radicals of the "new thought" in ventilation. In not one of the important investigations of the year was the open window solution proposed, even though the results obtained by other means were far from satisfactory. The agitation will no doubt die of its own accord wherever such methods are put into extensive use, but in the meantime it is a pity that there should be such a waste of time and effort, to say nothing of the confusion it is adding to a subject already sufficiently perplexing.

WE have seldom had the pleasure of publishing a more detailed analysis of an engineer's methods of computing an important heating system than is given on another page of this issue in connection with the mechanical equipment of a group of sanatorium buildings. That element of judgment in the use of formulas which is entirely the result of experience and which produces the variations that characterize the work of engineers of equal capability, is always interesting and often helpful. In this case the computations presented are so full as to offer an easy basis of comparison with the results obtained by any other method.

THE CONSULTING ENGINEER

"The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

23 Rules for Computing Hot Water Radiation.

QUESTION: Will you be kind enough to give me the method of computing hot water radiation, with rules determining the amount of square feet of radiation required for buildings?

ANSWER All direct radiation should be calculated in the same manner, whether for steam or hot water. The standard cast-iron radiation will transmit from 1.7 to 2 B. T. U. per square foot per hour per degree difference between the room temperature and the average temperature of the radiation per hour. These factors depend on the style of radiator and the velocity of the moving air and the difference in temperature either side. The greater the difference between the temperature of the radiator and the temperature of the room, the faster the rising air about the radiator passes over it.

Coils and wall radiators, also single-column radiators, will transmit 1.8 to 2 B. T. U. per hour per degree difference with steam at over 2 lbs. gauge. Three and four-column radiators, when over 32-ins. high, will transmit 1.6 to 1.8 B. T. U. with higher temperatures, and 1.5 to 1.7 B. T. U. with lower temperatures of steam or water. Low temperatures are used on vapor, and water systems with open tanks.

Hot water forced circulation will give somewhat higher values, due to the velocity of the fluid over the surface or practically the same quantity as for low pressure steam.

In proportioning radiation, the first step is to calculate the heat loss from glass, wall, cubic contents, roof or floor. These depend on factors, in this case taken from Hoffman's "Handbook for Heating and Ventilating Engineers," according to the type of construction shown on plans. When the B. T. U. loss for walls, glass, etc., are determined, the leakage should be estimated. This is largely a matter of guesswork and experience and is generally where most formulas in the hands of the novice will give a greater amount of radiation than necessary, especially for large rooms.

It is customary with many engineers to add an extra percentage for winds and exposure. The writer generally uses an air change of 1 per hour for all rooms under 4,000 cu. ft. and air change of 2 for all rooms up to 20,000 cu. ft. For larger spaces, the leakage should be less in proportion. As the wind may blow from any quarter and the sun may be obscured at times, it is the author's custom to make all rooms alike Thus the only factor depending on experience is the air change. This is also checked with a ratio of surface to cubic contents which is wholly experience, so would be of little use to others. He finds the method given will do the work without an excessive amount of surface.

We will assume a room 30 ft. x 24 ft. x 12 ft. high on the corner of a building having two walls exposed and roof. It is unnecessary to figure partition, floors or ceilings, unless the room is on the ground floor or adjacent to a cold space that is not heated. Skylights should be figured.

We will assume there are 20-in. brick walls, eight single-sash 8 ft. x 3 ft. windows 0° F. outside temperature and a room temperature required of 70° F. Hot water is to be the heating medium with a drop of 20° F., or 200° F. going out and 180° F. returning, or an average temperature of 190° F.

The air change would be calculated as follows: There are 8,640 cu. ft. of space and an air change once in two hours gives 4,320 cu. ft. of air to be heated per hour. 1 cu. ft. of air at 0° F. weighs 0.0864 lbs. and the specific heat of air is 0.2375, so for 70° rise each cubic foot will require 0.0864 x 0.2375 x 70° = 1.436 B. T. U. per cu. ft. 4,320 x 1.436 B. T. U. = 6,203.5 B. T. U. There will be 54 x 12 = 648 sq. ft. of wall, less the glass, 192 sq. ft., or 456 sq. ft. net of wall.

Hoffman (page 40) gives 23 as the factor for 20-in. brick wall and 1 for single glass. The wall will radiate 456 x 0.23 x 70° = 7,341.6 B. T. U. The glass will radiate 192 x 1 x 70° = 13,440 B. T. U. Roofs (fireproof) are given as 0.14 x 70° = 9.8 or, say, 10 B. T. U. 30 x 24 x 10 B. T. U. = 7,200 B. T. U. The total will then be for this room:

	B.T. U.
Air change	6,203.5
Wall	7,341.6
Glass	13,440.0
Roof	7,200.0
Total B. T. U. per hour	13,185.1

If water is used with gravity circulation or a vapor steam system with the same temperature, the drop in the water system will be about 20° F., or an outboard temperature of 200° F. and a return of 180° F., or 190° F. average. Assuming a transmission of 1.65 and the room at 70° F., the radiation will give off (190° — 70°) x 1.65 = 198 B. T. U. If there are 970 B. T. U. per pound of steam at atmosphere, the condensation from and at 212° F. per square foot will be 198 ÷ 970 = 0.204 lbs. per sq. ft. The square feet of surface will be 3,418.5 ÷ 200 = 170.8 sq. ft. The ratio of heating surface to cubic contents will thus be 8,640 ÷ 171 = 50, or about right for this size of room.

Figuring steam or water radiation is the same in method if care be exercised in using the proper temperatures outdoors and in the room, the proper temperature of the medium and the proper transmission factors. Most of the rules given in the books on heating and ventilation, if followed by contractors, would result in their obtaining no work, due to the excessive amount of radiation a strict following of the rules will give.

The ratio of surface to cubic contents, in the writer's judgment, is a little high for the conditions stated, but this is due to the low factor for single glass. The writer has generally used a factor of 1.22 instead of 1. This ratio should be about 1:45, or 192 sq. ft. of surface. This increase would be made or not if the conditions of the room as shown on the plans would warrant it. It will readily be seen that if one change per hour were used, it would increase the surface by 33 sq. ft. or 62,035 ÷ 198 = 33 sq. ft., making the total 200 sq. ft.

It is this air change improperly handled which makes the surface too great in many cases. By changing the temperature and solving, the fallacy becomes apparent of using a flat rate of steam condensation per square foot of heating surface for determining the necessary boiler power. If there is too much heating surface, the rate per square foot is reduced.

The writer, in figuring boiler power for heating on large plants uses the B. T. U. loss from the building and errors of calculating the radiation do not enter into the question.

ELBERT HUBBARD ON TRADE PAPERS.

4.—The Man Who Seeks Usually Is a Receiver.

(This series of artices commenced in the September, 1913, issue.)

We live in an age of investigation and interrogation, hence the success of the man who furnishes the truth and those who absorb it.

We are beginning to see into and through things and it's a case "if you don't see what you want, ask for it"—that's right. If you get more than you want of the wrong sort, that's right, too—it's a part of your education.

The boot has boosted many a man—some folks need firing to fire their imagination.

And when you have no imagination and no initiative, you are led—also lead—you don't radiate.

It is this imagination, fancy, gift of visioning that spells success. The dreamers are the workers.

"I could be bounded in a nut-shell were it not that I have had dreams," said Hamlet.

The reason we see so many peanuts in politics and in business is because their imagination is only limited to the cash register, their vision confined to the tape machine.

A man who wants to know the whyness of the wherefore or the thusness of the this, is in the line of evolution—of advancement.

When he begins to think his hide begins to crack, his muscles to expand—he becomes a white hope!

What a wallop "why" has! Try it on the next little cock-sure champion of canned philosophy you meet and watch him wince, wriggle, wilt and take the count.

Anybody can make a statement but to "show cause" is another proposition.

And the fellow who makes it his business to go around poking "whys?" into everybody's affairs is sure to get some nasty jars and jolts.

He must know how to guard as well as punch—to answer the "whys?" as well as to ask 'em.

There are three ways to attain knowledge: "To ask, to be told, to find out for yourself."

The first depends upon your assimilation, the next upon the skill with which the incision is made, and the last upon your perspicacity and perspicuity.

And not one of these processes alone can give you knowledge. They must be used in combination. You must be a seeker, a learner, and a doer.

No man lives to himself alone—we are part of all we have met.

The man who asks gets to know. The man, who, when told takes notice, grows. The man who works, wins.

His imagination, investigation and interrogation give him inspiration—the inspiration born of usefulness.

He stands erect upon his feet, stretching forward to seize every opportunity for advancement.

Our prehistoric ancestors, before the formation of language, used to make known their wants by signs.

When they were happy they danced the Tango—when they were mad they raised Cain.

For countles sages this obtained, and it is even said that previous to the Bostonian Era the inhabitants of this country simply barked at each other—and we can even hear some yelpings yet!

But with the growth of centuries, language of speech was evolved, and men began to hide their real feelings under a cloak of phrases and not a few to lie like some sophisticated lawyers.

Then came the printing press, the phonograph, the movies, osteopathy, and the player-piano.

All these things are the outcome of the eternal query, "why?"—the result of imagination, interrogation, investigation and work.

They are educators.

And the Trade Paper is probably the most alive to the urgency of education, and the gratification of the mental needs of its readers, than any other press production.

It asks, absorbs, gives.

Take up a Trade Paper—note the logic of its discussions, the well-expressed opinions of its contributors, the quality and texture of the paper, the clearness of the type, the beauty of its arrangement. Then tell me if it isn't an education—beautiful, inspiring, strengthening.

Thousands of Trade Paper subscribers are receiving mental uplift and renewing their courage by its means.

The Trade Paper is the leader, the reflector of the trade world.

It applies chiropractic methods to managerial meningitis, the numerical neuritis of the cashier, or the comatose businessman.

As a spinal adjuster the Trade Paper is a necessity. Without it there is great danger that the glooms will get you.

It manipulates the dislocated vertebrae of declining business until the spinal irritation walks its chalks, trundles its hoop, and you climb into your buzz-wagon again and let-er zip Gallagher!

The Specialized Trade Paper keeps the red corpuscles turkey-trotting, and prevents pseudoanginalitis or imitation heart-disease.

It helps you push business, thereby preventing nervous prostration. For nervous prostration is never occasioned by you pushing your business—it only happens when your business pushes you.

The Trade Paper is the Pathe Weekly of the subscriber.

It gives vivid character sketches of the passing great. It takes extensive tours over the fields of science, business and invention. It teaches by living, moving, word-pictures the reasons for the failures and the causes of success.

The business of religion is now giving place to the religion of business; and the trade paper is the evangel of the true brotherhood of co-operation and self-respect.

Show me the company a man keeps and I will tell you what he is.

Show me a man who subscribes to and reads his Trade Paper faithfully and you show me a man who will "show ME,"— a man alive, alert, ambitious, successful.

He has learned to ask, to seek, and to find. The Trade Paper is his guide, his encyclopedia, his friend.

HE is the WHY of the Trade Paper, and the Trade Paper could not exist otherwise.

The Trade Paper, specialized and classed, supplies him with mental uplift, increases his sum of knowledge, places him in touch with men and things. It is a cathartic, a tonic, and a developer.

And the Trade Paper subscriber in turn provides the gist.

Go to school to the men who know how.

The WHY of the Trade Paper is CO-OPERATION, the greatest force in the world today.

It exemplifies unity of purpose, of endeavor, of achievement. The getting together, holding together and pulling together—the elimination of imperfections and the materializing of ideas and ideals.

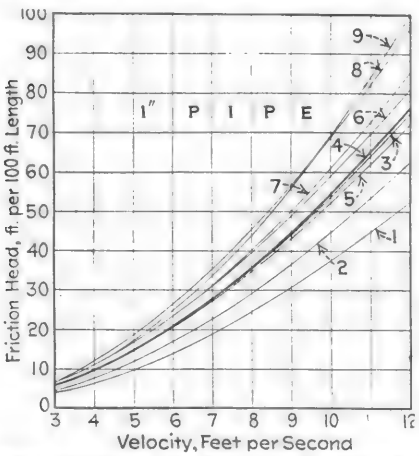
Subscribe for and thoroughly read your trade paper.—*Copyright*, 1913, *Kovnat Adv. Service.*)

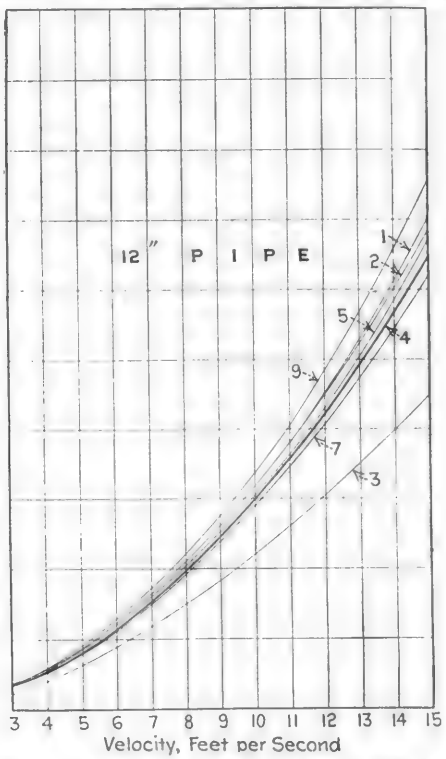
A Comparison of Hot Water Heating Formulas.

In connection with the article published in last month's issue on "Figuring Pipe Sizes for Hot Water Heating Apparatus," by I. V. Serginsky, it will be of interest to our readers to note, in the accompanying charts, a comparison of friction formulas for commercial pipe, in which the Serginsky formula is included. This comparison was compiled by Ira N. Evans and appeared originally in *Power* for July 9, 1912. The results were figured analytically and plotted for sizes from 1 in. to 12 in. and for velocities from 1 ft. to 15 ft. per second, inclusive.

In his article Mr. Evans stated that "Serginsky's formula was compiled from the latest German authorities. Although it was not available, the author has confidence in the results as far as computation is concerned. These were read from a logarithmic chart and appear to be high for small sizes and low for the larger sizes. The curve changes its position with reference to the average from high in the 1-in. chart to lowest in the 12-in. chart." It may be added that while the chart referred to was in the hands of a few engineering firms on this side of the water, its first publication, as well as that of the formula itself, was made in the November issue of THE HEATING AND VENTILATING MAGAZINE.

Incidentally, it is of inteerst to note that Curve 1, designated as the "Harrison formula," is the one used by James M. Harrison in his work on "Applied Heating and Ventilation." Of this formula Mr. Evans says: "It is exceeding simple and, although it gives results that are low for all sizes up to 6 in., the surprising fact is that they agree exactly with Poché's test of 1-in. wrought iron pipe and are very close to several tests of other sizes."





COMPARISON OF FRICTION FORMULAS PLOTTED FOR 1-IN. AND 12-IN. PIPE.

1. Harrison Formula.
2. Fanning Formula.
3. Serginsky Formula.
4. Average.
5. Williams and Hazen Formula.
7. Meier Formula.
8. Saph Schoder Tests.
9'. Darcy Formula.
9". Darcy Experiment with W. I. Pipe.

Heating and Ventilating Sections of Cleveland's New Building Code.

In the new building code of the city of Cleveland provision is made for the regulation of the ventilation and heating of school houses, tenements, theatres, department stores, the idea being to promote better conditions of hygiene in these buildings. Frequent air tests will be made by T. R. Quay, city heating and ventilating engineer, to see that the ventilation provisions of the code, at least so far as public buildings are concerned, are carried out.

The code provides that halls, auditoriums, schoolrooms, theatres and other places of public assembly or entertainment shall have in continuous operation while occupied a system of ventilation that will provide at least 25 cu. ft. of outside air per minute for each person for whom seating accommodation is provided. Department stores shall have a mechanical system of ventilation that will provide the following numbers of complete air changes per hour: Basements used for retailing merchandise, locker rooms, rest rooms and other rooms that are required by ordinance to be ventilated, six changes of air per hour; ground floor, six changes per hour; floors above the first, four changes per hour, unless natural ventilation is provided.

A mechanical system of exhaust ventilation is required for kitchens connected with restaurants that will exhaust the air six times per hour. However, if the restaurant and its kitchen are not separate, six changes per hour are required for both the restaurant and its kitchen. In factories in which there is less than 20 sq. ft. of floor space

for each employe a mechanical system of ventilators is required that will provide six changes of air per hour. If more than 20 sq. ft. of floor space is provided for each employe a system of ventilation is required that will provide four changes of air per hour, unless natural ventilation is provided as required by the city ordinance. In hospitals, jails, asylums, homes for the aged, houses of correction and detention, etc., where there are sleeping accommodations for more than ten persons, ventilation systems are required that will provide in dormitories, cell blocks, wards, public sitting rooms, toilet rooms, and in other rooms where the inmates congregate.

SYSTEM OF CHURCH VENTILATION.

Churches with a seating capacity of over 300, or where the clear story height is less than 15 ft., must have a mechanical system of ventilation providing six changes of air per hour. If the seating capacity is less than 300 or if the clear story height is 15 ft. or more a modified system of ventilation which shall meet the approval of the engineer shall be installed.

The amount of carbon dioxide in any new building in the foregoing classifications shall not be permitted to exceed ten parts per 10,000 parts of air. The amount of carbon dioxide in buildings erected prior to the enactment of the code shall not exceed twelve parts per 10,000 parts of air. If tests of ventilation show that the percentage of carbon dioxide in the air is greater than the maximum prescribed, the building inspector may require additional ventilation, even if the requirements of the code as to air changes have been complied with.

An exception to those standards of ventilation is made in the case of storage rooms and vaults or where manufacturing processes would be materially interfered with. However, the code provides that the air in such places shall not be permitted to become detrimental to health or safety.

No part of the fresh air supply is to be taken from the cellar or basement. No person shall be exposed to any direct draft from any air inlet. All poisonous or noxious gases and all dust which is of a character that is injurious to health in manufacturing plants must be removed by mechanical ventilation or exhaust devices.

VENTILATION OF TOILET ROOMS.

The code provides that the ventilation system for toilet rooms shall not be connected with any other ventilating system in the building, but shall be a complete system discharging above the roof. Compartments containing no more than four water closets and without sufficient outside windows must have a gravity or mechanical system of exhaust ventilation that will change the air six times per hour. Compartments with more than four water closets and having sufficient outside windows shall have a gravity or mechanical system of exhaust that will change the air six times per hour. In the latter case, if the outside windows are insufficient a mechanical system must be used that will provide six changes per hour. Rooms containing latrines or urinals with local vents are to be ventilated through the fixtures, and when such ventilation does not provide six changes per hour additional ventilation must be provided. Wire or cloth screens are required for filtering air in all fresh air openings unless some other approved method is provided.

No floor registers will be allowed in any aisle or passageway excepting in churches, and no register there shall be larger than 18 in. square. In theatres, churches, etc., at least one-fifth of the ventilated air shall be removed by registers located near the floor. No radiator or other heating device shall be supported on any supply or return piping construction to the same, but must be carried on the floor or on hangers fastened to the floor, wall or ceiling.

Warm-air furnaces must be supplied with fresh air from outside of the building through a duct having an area of at least 60% of the area of all warm-air pipes. This fresh air duct may have a by-pass connection to the vestibule or hall near an outer door, but no such connection shall be permitted for the use of air from the cellar. Floor furnaces are prohibited and those now in use must be removed within thirty days.

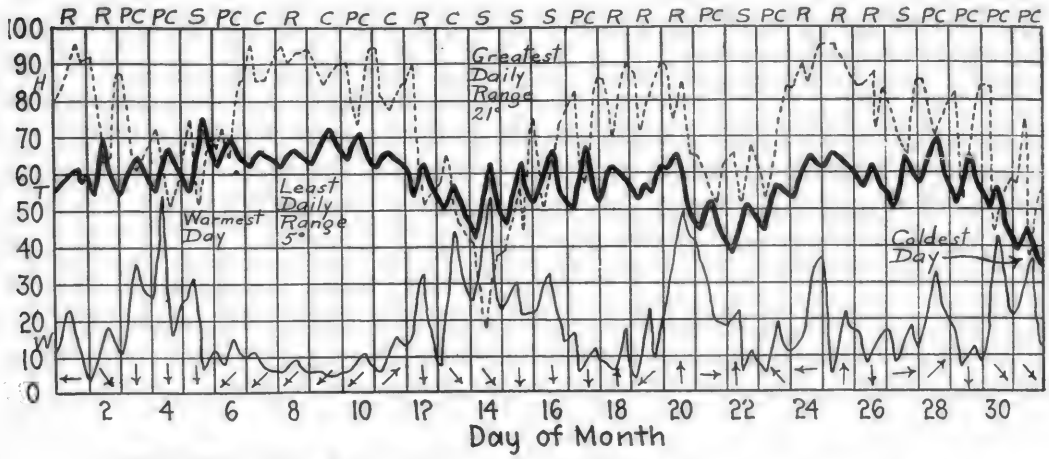
For Separate Heating and Plumbing Contracts in Illinois.

Heating and plumbing contracts for State work in Illinois are hereafter to be kept separate from the general contract, according to an arrangement made October 10 by the State Board of Health with representatives of the Illinois State Association of Master Plumbers. The master plumbers' association was represented by John L. Robertson, Mason City; Bernard Gause, Jacksonville; and Thomas J. Cody, A. J. O'Neill and Thomas F. McQuellan, of Peoria.

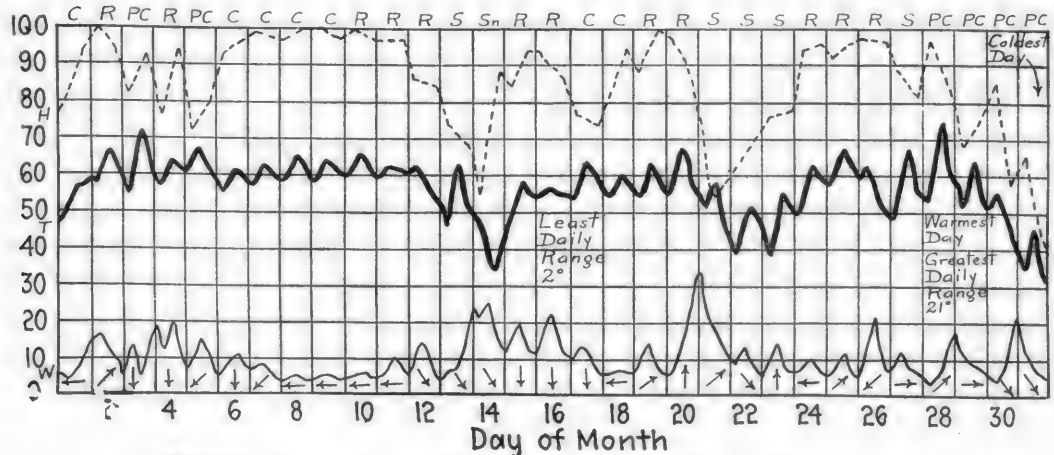
Among the papers read at the recent annual meeting of the American Institute of Chemical Engineers, held in New York, December 10-13, was one on "Ozone: Its Manufacture and Use," by Dr. A. Vosmaer.

The Weather for October, 1913

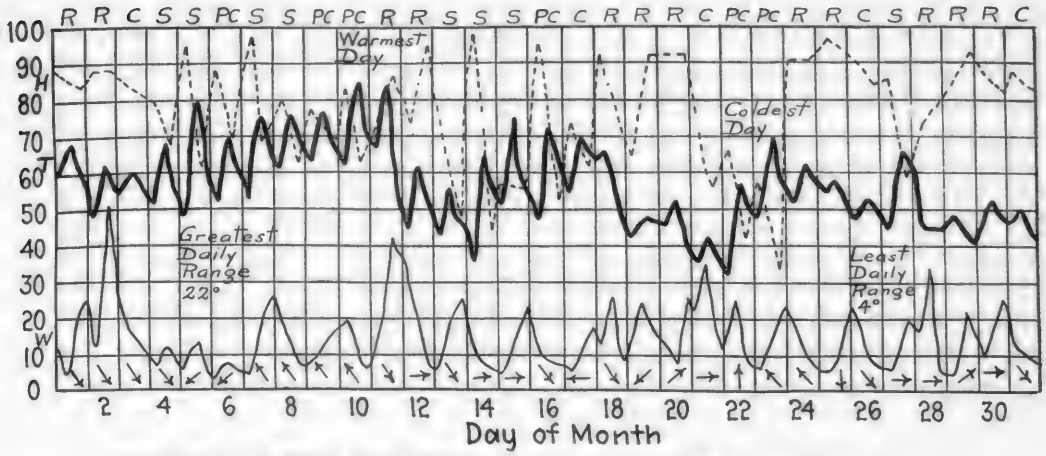
	New York.	Boston.	Pittsburgh.	Chicago.	St. Louis.
Highest temperature, degrees F	75	74	84	83	82
Date of highest temperature	5	28	10	10	6
Lowest temperature, degrees F	35	31	32	27	28
Date of lowest temperature	31	31	22	21	29
Greatest daily range, degrees F	21	21	31	21	24
Date of greatest daily range	14	28	5	26	12
Least daily range, degrees F	5	2	4	4	4
Date of least daily range	8	16	26	16	27
Mean. temp. for month, degrees F	58.2	56	55	53.3	56
Norm. mean temp. for month, degrees F	55.6	52.3	54.9	53.2	58.4
Total rainfall, inches	10.56	6.04	4.26	2.23	4.07
Total snowfall, inches	None.	0.4	T.	1.9	0.3
Normal precipitation this month, inches	3.71	3.86	2.36	2.55	2.41
Total wind movement, miles	12,734	7,179	8,191	9,097	9,218
Average hourly wind velocity	17.1	9.7	11	12.2	12.4
Prevailing direction of wind	N.	E.	N. W.	W.	N. W.
Number of clear days	7	5	9	12	11
Number of partly cloudy days	10	6	8	6	7
Number of cloudy days	14	20	14	13	13
Number of days on which rain fell	18	13	12	15	13
Number of days on which snow fell	..	1	..	1	1
Snow on ground at end of month, inches	..	..	..	..	..



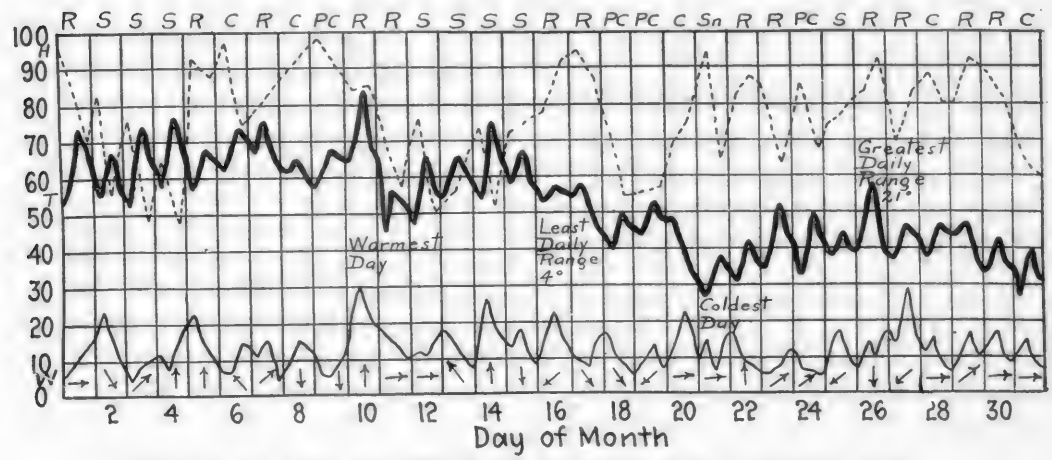
RECORD OF THE WEATHER IN NEW YORK FOR OCTOBER, 1913.



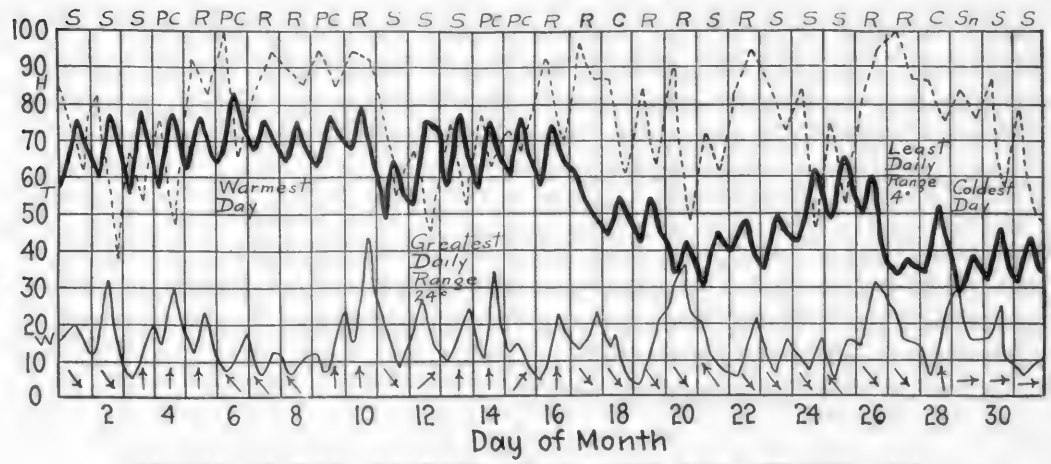
RECORD OF THE WEATHER IN BOSTON FOR OCTOBER, 1913.



RECORD OF THE WEATHER IN PITTSBURG FOR OCTOBER, 1913.



RECORD OF THE WEATHER IN CHICAGO FOR OCTOBER, 1913.



RECORD OF THE WEATHER IN ST. LOUIS FOR OCTOBER, 1913.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

Legal Decisions

Lighting Franchise May Include Power and Heating.

The United States Supreme Court holds that, in view of the decisions of the Nebraska courts that the doctrine of practical interpretation of contracts is applicable to public-service franchises, a municipal grant of a franchise to do a general electric light business must be deemed in Nebraska to include the distribution of electric current for power and heating as well as for lighting, where such has been the practical interpretation of the franchise by both the city and the grantee.—Old Colony Trust Co., vs. Omaha, 33 Sup. Ct., 967.

Exclusive Right Contract—Construction.

A person obtained by contract with the holder of the patent rights the exclusive right to manufacture and sell vulcan gas furnaces in the states of California, Oregon and Washington, and improvements on the furnace made during the life of the agreement. This right he assigned to a company by a contract which recited his exclusive right and granted to the company such right in *presenti* for specified royalties. In an action by him against the company for sums due under this contract it was held that the acceptance by the defendant of the grant was an admission of the plaintiff's right to make the grant. The defendant claimed that nothing passed by the grant, and that the furnace was in no respect covered by the patents. It was held that the defendant must establish that fact by competent evidence in order to avoid liability for royalties.—Martin vs. Finney, California Supreme Court, 126 Pac. 481.

"Interstate Commerce" Sale.

A bankrupt, who did business in Alabama, ordered three car loads of furnaces from a heating and ventilating company, a corporation of another State. Two car loads were received and accepted, but, on notice of shipment of the third, the bankrupt objected that it was premature, because it was not ready to receive it, nor prepared to meet the payment on the terms of credit given. It was then agred that it should receive the furnaces and hold them on consignment, with the right to sell by consent of the seller in each case. The bankrupt subsequently agreed to purchase the same and gave its notes at the prices fixed by the original order. The seller's claim for the price of the third car load was subsequently disallowed by the referee in bankruptcy upon the theory that the contract therefor was void on account of the failure of the seller, as a foreign corporation, to qualify to do business in the State of Alabama and the goods being in Alabama when sold. It was held that the transaction was continuous from the beginning, and the sale referable to the original order, the subsequent modification being merely for the purpose of postponing the period of delivery, that the sale was one in "interstate commerce," not affected by the Alabama statute, and the note was valid and provable against the bankrupt's estate.—In re Selman Heating and Ventilating Co., 204 Fed. 839.

What are "Winter Months" in a Covenant to Heat Premises?

A lease which provided that the lessor should furnish heat during the "winter months" did not show whether the term was used in its technical or popular sense. It was held to be ambiguous, and evidence was admissible to show what was meant. In common language, the "winter months" are the cold months; but, when the language is used with greater scientific accuracy, the months of December, January and February are meant. The astronomer, on the other hand, would say that the winter, north of the equator, lasts from the winter solstice, about December 21, till the vernal equinox, about March 21.—Whitney vs. Aronson (Col.) 130 Pac. 700.

New York Chapter Discusses Vacuum Steam Heating.

The champions of vacuum steam heating had their innings at the November meeting of the New York Chapter, held in the Engineering Societies Building, November 17. The subject, as prepared by Chairman J. A. Donnelly of the committee on arrangements, was subdivided as follows: "Vapor vs. Low Pressure Gravity Heating Systems; Amount of Radiation to Be Used with the Two Systems; Vacuum vs. Back Pressure Systems; Vacuum Systems on Live Steam Plants; Sizes of Supply and Return Mains; Capacity of Vacuum Pumps; and Vacuum on Blower Systems."

The first topic was introduced by George G. Schmidt who read a discussion he had previously prepared for presentation at the annual meeting of the society. He spoke of the general attitude towards various heating systems and asked, "Is any change in popularity taking place between one-pipe steam systems, hot water systems and two

pipe steam systems?" "It is claimed by many," he added, "that a thoroughly reliable and satisfactory air valve is yet to be invented, and that either the one or two-pipe system should be provided with an air line. In both the one and two-pipe steam systems, it is necessary to exercise care in completely opening and closing the valves in order to prevent the radiators filling with water. The last consideration, as well as the possibility of modulating the heating of any radiator, has led to the introduction of the two-pipe vapor system and to its adoption to quite a considerable extent. It is claimed by many that vapor systems are growing in favor very rapidly and replacing systems that were formerly installed as hot water or one-pipe steam systems. The non-use of air valves on the coils and radiators and the limitations of their use to the basement or cellar are claimed to be of sufficient attraction to bring this method into very wide use."

Charles E. Warsop said that vacuum heating has suffered from the fact that too much had been claimed for it. He spoke of the introduction of vacuum heating in Denver which is a mile above sea level. Here he said trouble was experienced due to the high level which at first was not taken into account. As a rule, it was necessary to add 10 per cent. more radiation for such altitudes.

Frequent cause for vacuum heating systems failing to give satisfaction are small supply pipes and it is not always borne in mind that the pump produces a vacuum only from the return valve to the pump. Formerly the vacuum manufacturers made plans and specifications. One manufacturer would get a competitor's plans and would cut down his own pipe sizes to arrive at the lowest figure. Another trouble has been that people would often throttle a valve on one-pipe air line systems, resulting in an accumulation of water in the radiator. The boilers used to be at fault, but the large headers now used prevent priming.

The speaker advocated return line systems for buildings covering large areas and two-pipe air line systems for office buildings.

J. Haggerty described the installation of one of the first Webster systems in New York, at Broome Street and Broadway. When he first saw it he said the vacuum pump was placed 10 ft. above the return line. As a result the drips short-circuited from the steam main into the return. This trouble was remedied by locating the pump on the floor and placing thermo valves on the drips.

Walter S. Timmis said that the installation of single-pipe systems where there are no power plants is generally very satisfactory. The great advantage of vacuum steam heating is that it is possible to get a lower radiator temperature than with either of the other systems. We get a better quality of heating if we keep down the radiator temperature to that of hot water heating systems and, in addition, regulate the radiators so that only a portion of each is heated, as desired. He endorsed the graduated valve and said that in all cases where there is a power plant, vacuum heating systems will pay for themselves, if the heating system is large. They are not desirable, however, unless the radiation is widely separated and a long distance from the boilers. The best kind of device to use in vacuum heating work is one that will allow water and air to pass and which will limit the passage of steam to that which will condense in the return line, so as not to kill the vacuum in the pump.

Frank G. McCann said that in the Board of Education work, it was not customary to use a vacuum heating system if it can be avoided. He said he had used vacuum return valves without any vacuum with good results. Jet water, he said, should not be necessary. The minus pressure at the pump may be increased, but the radiator is not affected. When the pipe sizes are large enough, good results are obtained by using one-pipe systems, with thermostatic control.

Mr. Timmis asked if any method was known for controlling the radiators on a one-pipe system. Mr. Donnelly told of the attempts that had been made to accomplish this, such as the use of an air valve on the first loop and of the use of hot air circulated with the steam. He said one of the best arrangements was that in which the return connections are carried separately from each radiator.

Of the general advantages of vacuum steam heating, Mr. Donnelly emphasized the fact that such systems start up more quickly, that they prevent short circuiting and there is not a counter flow into the radiator. He also spoke of the expansion of the risers with increased pressure and of the troubles experienced in gravity systems when the tenants do not shut off both valves. Mr. Donnelly spoke at length on the subject of vacuum pumps and of his experiences with them, showing among other things what quantities of grit a vacuum pump will accumulate and the curious effects this grit has on the pump.

Other speakers were Messrs. Chase, Reynolds and Feldman. Vice-President J. I. Lyle presided in the absence of President D. D. Kimball.

Illinois Chapter's November Meeting.

Thirty-one members attended the November meeting of the Illinois Chapter, the topic for discussion being "Downward vs. Upward Ventilation." Previous to the opening of the debate the presentation of a drinking set consisting of a Thermos bottle, cups and tray, was made to Secretary W. L. Bronaugh in appreciation of his services to the chapter.

The business items reported at the meeting included the reduction of the annual dues to $5.00. A letter was read from the Chicago Ventilation Commission asking that the society's present representatives on the commission be continued, consisting of Messrs. Hart, Lewis and Davis. A letter was also read which had been sent by the chapter to Health Commissioner Young, commending his efforts in connection with the enforcement of the ventilation ordinance.

Among those who spoke on the topic of upward and downward ventilation were S. R. Lewis and E. L. Hogan.

The topic for the December meeting is "Forced Circulation of Hot Water vs. Vacuum Steam Heating."

Massachusetts Chapter.

At the November meeting of the Massachusetts Chapter, the subletting of contracts and fire hazards in public buildings were up for discussion. Those who spoke on this subject were A. B. Franklin, W. W. Underhill, Andrew G. Paul, William N. McKenna, Elmer S. Bailey and Sidney F. Hooker. Secretary Frank Irving Cooper, who attended the International Congress on School Hygiene, in Buffalo, gave an account of the papers and discussions at that meeting.

British Institution of Heating and Ventilating Engineers.

A total membership of 482 was reported at the autumn meeting of the British Institution of Heating and Ventilating Engineers, held in London, October 14. Two professional papers were on the programme, one by George Chasser on "Temperature Guarantees and the Heat Loss Factor" (published in abstract in THE HEATING AND VENTILATING MAGAZINE for November), and one by Alfred E. Wheeler, on "Accelerated Circulation." In addition, the members were treated to a lecture by A. H. Barker on "The Reading of a Thermometer," in which Mr. Barker reviewed the work that had been done in the department in his charge at the University College.

Kenneth Gray of London was elected president of the institution for 1914, and E. Herring of London was made vice-president.

Organization of The Vacuum Cleaner Manufacturers' Association.

A new trade organization which will be known as The Vacuum Cleaner Manufacturers' Association, was formed in Toledo, Ohio, October 11, as the result of a call sent out by The Bissell Motor Co., of that city. Those present at the organization meeting were:

E. W. Adams, Advance Mfg. Co., Kalamazoo, Mich.

Fred Bissell, Bissell Motor Co., Toledo, Ohio.

Adam A. Breuer, Clements Mfg. Co., Chicago, Ill.

J. R. Spencer, Duntley Products Co., Erie, Pa.

W. C. Horr, L. N. Sturdevant and C. D. Bushnell, Eclipse Electric Cleaner Co., Sidney, O.

W. C. Horr, E. W. Hoyt and L. N. Studevant, Eclipse Electric Cleaner Co., Sidney, O.

C. D. Bushnell, Electric Renovator Mfg. Co., Pittsburgh, Pa.

Fred Wardell, A. J. Stecker and O. F. Binford, Eureka Vacuum Cleaner Co., Detroit, Mich.

C. F. Beck, Federal Sign System Co., Chicago, Ill.

H. W. Hoover, Hoover Suction Sweeper Co., New Berlin, O.

J. C. Sullivan, Premier Vacuum Cleaner Co., Cleveland, O.

C. F. Eberhard and Henry Prell, Victor Vacuum Cleaner Co., Cleveland, O.

The meeting organized by electing Fred Wardell temporary chairman and Fred Bissell temporary secretary and treasurer. The election of these officers was later made permanent. An executive committee was appointed by the chair consisting of Fred Wardell, chairman; H. W. Hoover and J. R. Spencer.

The objects of the new association, as formulated are:

Better acquaintance among the members.

To aid each other in every way possible.

To discuss and prevent some present abuses under which the business is suffering.

To discuss credits, consignments and selling methods.

To secure standardization, as of fittings, if that can be done.

The exchange of repair parts between different manufacturers.

Benefits of exhibitions at electrical shows, fairs, etc.

Development of better selling ability among the dealers.

Uniform guaranty.

How well does advertising pay?

What is a reasonable discount to a dealer?

Collection of data from which to compile a history of the electrical cleaner business; and

To investigate the propriety and the benefits of some general publicity for the good of the entire business, but sharply distinguished from individual publicity.

On request the meeting was addressed by Major W. H. Porter, of the McManus Advertising Company, who has conducted several campaigns of this kind with results highly satisfactory to the promoters.

Each member was assessed $5 for temporary expenses. The secretary was instructed to report to all manufacturers of electric vacuum cleaners, whether stationary or portable, giving details of the purposes of this association, and ask them to join, and each member of the present organization was requested to assist wherever he can. The meeting then adjourned, subject to the call of the chairman.

New York's Bakeshop Law.

In the new labor law of New York State, a number of important changes are to be noted governing bakeries and confectioneries. One provision is to the effect that in the enforcement of the bakeshop act health departments in cities of the first class are to have exclusive jurisdiction. The act prohibits the future location of a bakery in a cellar and it makes stringent regulations for those already so situated. It is also stipulated that "mechanical means of ventilation, when provided, shall be effectively used and operated," and that "windows, doors and other openings shall be provided with proper screens."

Chicago City Council Upholds Ventilation Ordinance.

Pending the consideration of a proposed amendment to the ventilation ordinance of Chicago, the building committee of the council has voted to give Health Commissioner Young full power to enforce the ordinance. The last report of the health department showed that of the 606 theatres in Chicago, only 177 have fully complied with the ventilation ordinance. Of the balance, 222 have supplied exhaust fans, while 207 have no positive ventilation at all. The daily attendance of children at these theatres, according to a health department expert, is 150,000. Those present at the meeting on behalf of the theatre owners included Theodore Weinshank of Indianapolis and Prof. McCormick of the Armour Institute.

In connection with the agitation for an amendment to the ordinance, Mrs. Harriette Taylor Treadwell, president of the Chicago Political Equality League, has started a movement to create moving picture shows in the public schools of the city. "There is air enough in the schoolrooms," she said, "for it is changed every seven minutes throughout the day." Mrs. Treadwell is principal of the West Pullman School.

Activity on the part of another women's organization in Chicago, the Woman's City Club, resulted in an inspection tour by six groups of members to determine the need of enforcing the present ventilation ordinance. It was stated that few of the theatres came up to the necessary requirements.

Air Intakes for Chicago's School Criticised.

According to a report just made by the Chicago Civil Service Commission, startling conditions have been found in the Chicago schools in connection with the air supply. In many buildings, it is stated, the investigators found street dirt of the most dangerous description being sucked in by high powered fans and circulated through the rooms.

"The air intakes of the ventilating systems," says the report, "sometimes are located at the ground level and open directly onto a street or alley.

"Where there is no screen or air washer the fan sucks in manure and other street dirt, and carries it to the classrooms. This condition, which was found in many older and in some comparatively new buildings, is inexcusable and should be remedied at once.

"When one considers the condition of the air near the ground on a windy day it is apparent that an air intake taking in 30 cu. ft. of air per minute per pupil should not be located at the ground level on a street or alley without an air washer or even a screen."

The report recommends the relocation of those air intakes now situated at ground level, placing of fine mesh screens over the opening and the installation of either humidifiers or air washers in connection with all school ventilating systems.

Class in Heating and Ventilating Organized in New York.

A class in heating and ventilation has been inaugurated by a number of men in the heating trade in New York, the idea being to provide a course of instruction for persons who are limited in both time and

money to perfect their knowledge in this line. Twenty-two lectures have been arranged for, to be delivered by C. A. Fuller. The meeting place is Room 511, World Building, where the class assembles every Monday evening. The first lecture was given December 1 when the success of the venture was assured by the enrollment of over 22 students. In succeeding lectures the topics to be taken up will include purification of the air, types of heating systems, computation of heating surfaces, etc. The advisory board consists of J. A. Donnelly, M. J. Sage, W. J. Olvany, F. K. Chew and A. D. Hoxie. George G. Schmidt, 132 Nassau St., New York, who has been active in the formation of the class, is the secretary. The fee for the complete course is $10.00.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HOSPITALS.

Heating and Ventilating in Greenpoint Hospital. Harold L. Alt. Illustrated description of a new hospital in New York State, provided with the most modern equipment. 2000 w. Dom Engng—Aug. 23, 1913. 20c.

VENTILATION.—

Ship Engine-Room Ventilation. Illustrated description of the new method of ventilation installed on the "Lusitania." 800 w. Engr., Lond.—Aug. 29, 1913. 40c.

The Ventilation of Modern Battleships. R. D. Gatewood and Charles M. Oman. Discusses the need of ventilation, the difficulties, the aids and methods available. 6,000 w. Pro. U. S. Nav. Inst.—Sept., 1913. 80c.

Ventilation Standards and Ventilation Methods. R. C. Carpenter. Explains the problems entering into the work of proper ventilation, discussing the requirements and related subjects. 4,000 w. Jour. Assn. of Engng. Socs. —Sept., 1913. 40c.

Ventilation of Steam Turbine Engine Rooms. Edgar Knowlton. Cites the growth of typical plants and shows how imperative it is that attention be given to the ventilation of the engine room. Describes the most approved methods. 4,000 w. Gen. Elec. Rev.—Sept., 1913. 40c.

For a Federal Board of Health in Canada.

A movement to establish a Federal Board of Health in Canada, has been inaugurated by J. D. Hazen, of the Dominion House of Commons, and at a recent meeting to further the project, the plan received the endorsement of Provincial representatives from every province in Canada. At this meeting Mr. Hazen presided as chairman.

The original purpose of those favoring the new department was to prevent the further pollution of the navigable water supplies in Canada, but it has been proposed that the scope of the proposed board be enlarged to include a board of examiners of Provincial health officers, examiners of sanitary engineers, board of arbitration for boundary streams, a sanitary engineering department and a heating and ventilating engineers' department. In connection with the latter sub-division, the idea has been advanced by The Sanitary Engineer to provide for a Federal depot of health, comprised of a board of heating and ventilating engineers to compile various standards in connection with climatic conditions and plans and specifications for heating and ventilating apparatus.

Methods for Supplying Humidity to Rooms.

Some of the difficulties in the way of properly humidifying the air in houses was brought out in the course of an article on "Deficient Humidity Indoors," written for a Duluth paper by H. W. Richardson, forecaster for the United States Weather Bureau in that city.

"Methods," he said, "have been devised for supplying moisture to the air of houses, but a few figures to show the amount of moisture required to bring the air up to a normal healthy condition will be found to be somewhat discouraging (so far as the efficacy of pans go). Thus in an ordinary sized dwelling house, when due allowance is made for the amount of air required by each person per day, something like 33 gals. of water must be evaporated to keep the air at a relative humidity of 75%.

"Other difficulties arise when this is accomplished. Condensation takes place on the windows when the air temperature outside is very low. Experience has shown that this commences at a humidity of about 40%. We are inclined to think that much could be accomplished by maintaining the humidity, even at this latter figure, and that the question should be earnestly considered in order to improve the general conditions in artifically heated buildings.

"However, other tests prove that the case is not hopeless and that the foregoing conclusions are not final. Dr. Barnes of Boston devised an apparatus which he placed over the delivery register and which device evaporated on the average about 4½ quarts of water daily. By this means he

claimed he was able to maintain a relative humidity of 53% in his own office, and the resulting increased humidity kept the place comfortable at a temperature of 65° while under the usual drier conditions the room had a temperature of 70° to 71°. As a matter of fact where pans of water can be placed in the furnace hot air chamber the evaporation is very rapid, and the moisture content of the heated air circulating through the house is materially increased. Especially would this be true if hot air furnaces were equipped with an arrangement of some sort of water reservoir, which could be continuously repleted, and whose superficial area provided evaporation in proportions so regulated as to secure any desired moisture condition. This latter, it is believed, could be secured through more or less extensive experimentation on the part of the manufacturers of furnaces. As already intimated, very little, comparatively speaking, has been done along this line. Steam humidifiers are now available for steam and hot water systems, which have heretofore offered the most difficulty to obtain sufficient moisture. Wherever installed it is claimed these humidifiers have proved quite efficacious."

New Arrangements to Control Air Supply Fans.

A new device to be used in connection with a fan ventilating system has been put into operation in Hubbell Hall at the Michigan College of Mines, Battle Creek, Mich. In any public building, and especially in school and college buildings, most of the rooms are occupied only part of the time. The fans, however, must work all of the time for all of them. By this new device the current of fresh air driven into the rooms is shut off automatically with the ringing of the bell at the close of the recitation period, and it does not go on again until turned on by the instructor when he enters the room for the next class. Thus the maximum load the fan must carry is generally reduced, and the average load is nearly cut in two. Hubbell Hall has been until now without ventilation, and the new system is the result of a special appropriation made by the last legislature.

Albums of Heating and Ventilating Installations.

A noteworthy undertaking has recently been completed by the B. F. Sturtevant Co., Hyde Park, Mass., in publishing what may properly be described as albums of typical heating and ventilating installations. The work is of such proportions that the plan was adopted of publishing it in sections. One section, for instance, is devoted to the heating and ventilating of school buildings, while another is confined to factories and railway buildings. In each case the blower and fan equipment is of the Sturtevant make, the whole constituting an impressive exhibit of the wide extent of the company's business. In addition to the plans, which have been especially drawn for this publication, the illustrations include photographs of buildings and equipment, accompanied by much valuable descriptive matter. The work is published for special distribution, but no doubt may be had on application by those directly engaged in the design and installation of heating equipment. The sections are of uniform size 10½x8 ins. and contain 100 pages and 68 pages, respectively.

Interesting Principle of Construction in a Water Faucet.

The washerless faucet shown herewith is described as the only faucet with a conical valve or jumper bearing directly on a spherical seating. With this seating, leakage is impossible, as the contact between a spherical surface and a hollow enveloping cone is in every possible position a true circle. This principle enables the valve of the new faucet to find a true seat, even when the top action of the cock is not axially true with the body. In applying this seating the ideal line contact is obtained, and there is no possibility of cutting.

Owing to its peculiar form of construction, it is impossible for solid particles to remain between the valve and seating when closed. And as no washers are used, the destruction of seatings by chemical action due to the use of leather, rubber, etc., so common in ordinary valves, is entirely eliminated.

The valve and seating form a separate unit in themselves, and are easily and quickly removed should it ever become necessary.

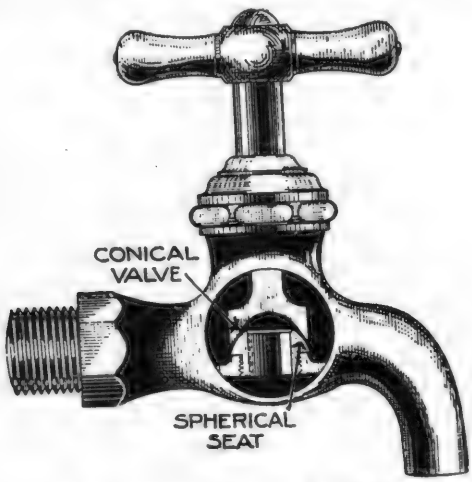
Other features of this new faucet, which is known as the J-M washerless faucet, are the absence of hammering, and also the absence of whistling under high pressure. It operates as well on high pressure as on low, and is equally efficient on hot and cold water lines. It is quick and easy in action, shuts off dead, and doesn't splash.

The J-M washerless faucet is an English patent and has been in successful use in Great Britain and other countries for years, where it has become famous for its dependability. Many prominent engineers pronounce it the most perfect faucet on the market, and its merit is fully demonstrated by the fact that it is authorized

by the Metropolitan Water Board of London and other cities.

This faucet is now being manufactured in all standard American forms by the H. W. Johns-Manville Co., New York. All parts are interchangeable. Under average conditions the makers claim that this faucet will last a lifetime and each seating is guaranteed for a period of ten years. The J-M washerless faucet is also adaptable to all requirements in the handling of oils, chemicals, and other liquids. Where water contains salt in solution which set up galvanic action on coming in contact with different metals or alloys, the seating and valve will be furnished in alloys which will remain unimpaired.

The above-named firm has just issued an interesting booklet describing this remarkable faucet in detail, and will gladly send a copy to anyone interested.



J-M WASHERLESS FAUCET.

A New Recording Hygrometer.

Recording hair hygrometers, giving a single record of the relative humidity, have been in use for a long time. Engineers have appreciated the distinct advantage of having a record of both the dry bulb temperature and the wet bulb temperature independently but simultaneously on the same chart. Such an instrument has the added advantage in the ease with which its accuracy can readily be checked with a standard thermometer at all times. The importance of proper conditions of temperature and humidity is being more and more appreciated in its effect on health and human efficiency, as also on the effect on many products during process of manufacture.

To meet the growing demand for an accurate and reliable wet and dry bulb recording thermometer, The Industrial Instrument Co., Foxboro, Mass., has designed and placed on the market the recording hygrometer, illustrated in Fig. 1. It consists of two sensitive bulbs mounted in tandem back of the case as illustrated in Fig. 2, the wet bulb being jacketed and kept moist by maintaining water at a constant level in a trough beneath. The pen arms are attached directly to shafts concentric with the helical tube bulbs. The case is mounted on a swivel bracket enabling swinging the instrument at right angles to the wall or support, giving easy access to the inverted glass bottle serving as water reservoir. It is made in three sizes, viz.: 8-in., 10-in. and 12-in., corresponding to the standard sizes of Foxboro recorders and to cover ranges between freezing point and boiling point of water (32 to 212 degrees F. or 0-100 degrees C.).

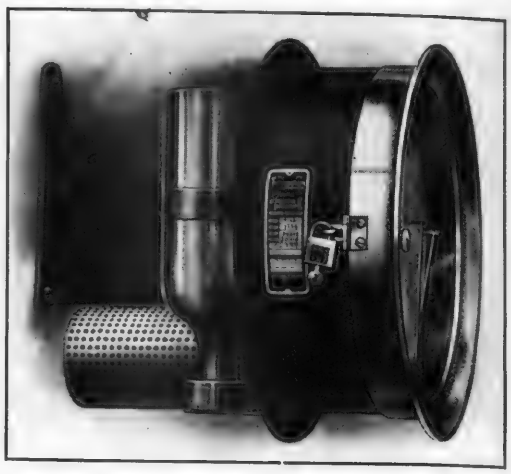


FIG. 1.—NEW TYPE OF RECORDING HYGROMETER.

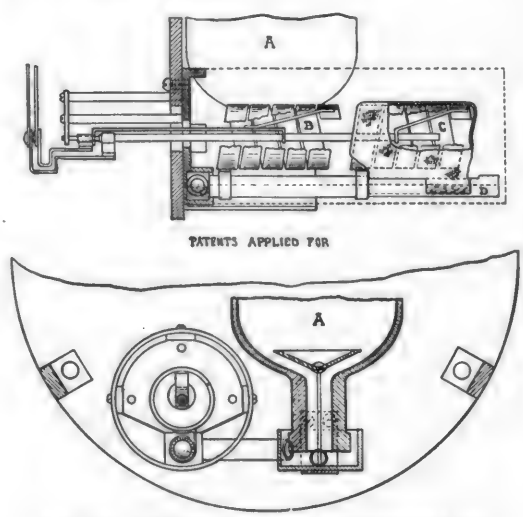


FIG. 2.—INTERIOR ARRANGEMENT OF NEW RECORDING HYGROMETER.

Trade Literature.

INTERNATIONAL HANDY REFERENCE BOOK FOR 1914, published by the International Heater Co., Utica, N. Y. is an unusually well-arranged manual, the principle improvement being the division of the matter into four distinct sections, each of which is easily distinguishable by the tint of the paper. Section I tells all about the International line of boilers. Section II lists and prices all repair parts, in addition to containing a complete International dictionary. Section III is much more complete than in former editions, containing full data on radiators, valves, regulators, etc. Section IV is a boiled-down compendium of heating data, with enough "reason why" explanation to make it clear. It is strongly bound in flexible cloth. A copy, we understand, may be had for the asking. Pp. 160. Size 3 ¾ x 6 ½ in.

ELECTRIC PUMPING MACHINERY made by the Chicago Pump Co., Chicago, Ill., including the the company's line of electric driven multi-stage turbine house pumps, are described in a newly-issued catalogue. One of the features of the catalogue is a set of specifications covering this type of pump as well as others made by the company. Illustrations are included of representative installations and full data are given for the various sizes and styles. The Chicago automatic electric condensation pump, which is especially designed to avoid digging boiler pits, is presented with prices and sizes covering capacities from 1000 to 25,000 sq. ft. of radiation. Another of the company's products noted is the Cycloidal vacuum pump built especially for vacuum heating systems. Pp. 48. Size 6 x 9 in. (standard).

J-M ASBESTOS ROOFING AND WATERPROOFING SPECIFICATIONS for the modern architiect, engineer and builder are the subject of a catalogue of unusual attractiveness published by the H. W. Johns-Manville Co., New York. Pp. 46. Size 6 x 9 in. (standard).

CONNERSVILLE VALVELESS VACUUM PUMP is the subject of a new bulletin (No. 12) received from the Connersville Blower Co., Connersville, Ind. This pump is the improved form and latest development of the cycloidal pump which has been manufactured by this company in sizes up to 1,200 gal. per revolution since 1893. The bulletin includes the piping and connections for three typical installations, one for a system using standpipes, another for a system using receiver tank and the third for a system witih return tank. A dimension sheet, and tables of sizes, capacities, speeds, etc., for sizes from 3,000 to 57,600 gal. per hour are also given, together with an impressive list of fifty installations in all parts of the country. Size 8½ x 11 in. Pp. 4.

TOLD IN A FEW WORDS is the title of a condensed circular showing and describing the steam heating specialties made by the McDonald Vacuum and Vapor Specialty Co., Cleveland, O. These devices embody a number of original ideas in vapor and vacuum devices and are the result of a long experience in this class of work. Included in those shown are the McDonald automatically controlled hydraulic exhausting apparatus as connected with air line heating systems of the McDonald hydraulically driven pump and various styles of the McDonald automatic temperature control devices for use in connection with air line systems or regular one or two-pipe gravity systems.

ECONOMY PUMPING MACHINERY, to which Thomas & Smith, Chicago, are now devoting themselves exclusively, is the subject of a new catalogue issued by them which shows the completeness of this company's line of pumps. A prominent place in the catalogue is occupied by the Economy dry pump chamber sewage ejector, which is accompanied by a suggestive specification covering this apparatus. The other types are treated in a similar manner, including the Economy standard automatic condensation pump and receiver, which has attracted such wide attention following its recent introduction to the trade. Another type is the Economy underground automatic condensation pump and receiver for use in connection with heating systems where the return line is below the floor. Complete data is given with each type of pump shown, together with considerable miscellaneous information on current requirements for motors, pipe friction, etc. Pp. 84. Size 6x9 in. (standard).

SPRAGUE ROUND-TYPE DIRECT CURRENT MOTORS are treated exclusively in Bulletin 247, just published by the Sprague Electric Works of the General Electric Co., New York. Full ratings and dimensions are included. Pp. 24. Size 8x10½ in.

IDEAL HEATING JOURNAL for November, the monthly periodical of the American Radiator Co., Chicago, contains an article of timely interest on "Heating and Ventilation of Amusement Halls and Theatres." Plans are included showing several typical methods of ventilating such buildings and illustrating the adaptability of Vento heaters to this class of work.

EVEN HEAT 12 HOURS WITHOUT ATTENTION is emphasized as a distinguishing feature of the Spencer heater in circular matter recently published by the Spencer Heater Co., Scranton, Pa. The water jacket feature of the Spencer magazine and the sloping grates, insuring an even depth of fire, are other points brought out.

Modern Vacuum Cleaning Apparatus

14. Regina Pneumatic Cleaners.

Portable cleaners, both hand and electrically operated, are included in the product of the Regina Co., 47 West 34th Street, New York. The accompanying illustrations show the two types of the company's electrically-operated apparatus. In Model B, a double pump is used, operating alternately, giving a continuous instead of an intermittent suction.

The Regina Model B contains two separate diaphragms or pumps, driven by an electric motor at a rate of 2,400 impulses per minute or 1,200 per minute for each pump. The pumping is done on the upward stroke. The eccentrics which operate the pumps run in ball bearings to reduce friction. The machine itself rests upon roller bearing feltoid casters. The working parts become accessible when the cover is removed. The dirt bag is relatively large and the collected sweepings may be removed without the necessity of taking out bolts or screws. The bag is below the pumps so that as the dust and dirt settle to the bottom of the bag, the upper part of the bag is left free for the passage of air. With this arrangement the suction may be kept high until the bag is nearly full.

REGINA ELECTRIC CLEANER, MODEL B.

The machine is placed in operation by connecting it with an ordinary electric light socket. It weighs 50 lbs., and is 18 in. long, 10¼-in. wide and 18¾-in. high.

Another model (Model C), made by this company, is mounted on rubber-tired wheels and is rolled over the floor like a carpet sweeper, but it may be also used, with hose and other extra attachments, to clean curtains, furniture, etc. It is equipped with a small, specially-constructed electric motor for direct or alternating current, as desired, operating a rapidly-revolving fan.

REGINA ELECTRIC CLEANER, MODEL C.

In this model the dust bag is not suspended from the handle but is encased between the intake and the motor. The machine may be operated as a blower by connecting a hose to the exhaust opening. This apparatus is 22 in. long, 7 in. wide and 7½ in. high.

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15. Domestic Vacuum Cleaners.

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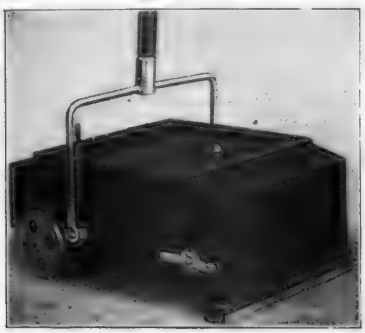

DOMESTIC VACUUM CLEANER.

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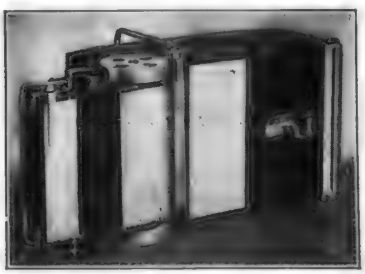

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*Every other month.

MONASH NOISELESS SYSTEM OF VACUUM HEATING

SILENCE EFFICIENCY ECONOMY

Used with entire success in HOSPITALS, HOTELS, CLUBS, THEATRES, FACTORIES, SCHOOLS, COLLEGES, OFFICE BUILDINGS and PUBLIC INSTITUTIONS where **ELIMINATION OF NOISE** from the heating plant is desired.

NEW MICHIGAN CENTRAL DEPOT, DETROIT, MICH.
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THE HEATING AND VENTILATING MAGAZINE

Vol. X. No. 12. $1.00 a year. 10 cents a copy

NEW YORK, DECEMBER, 1913

Publication Office: 1123 Broadway, New York

GURNEY HEATERS

FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER
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ADJUSTABLE
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COPPER AND GALVANIZED IRON
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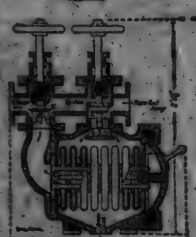

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Will Keep Oil out of Your Boiler
Regulating Valves
For Water Steam Air
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IMPROVED WOOD STEAM PIPE CASINGS

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SIMPLE DURABLE EFFICIENT
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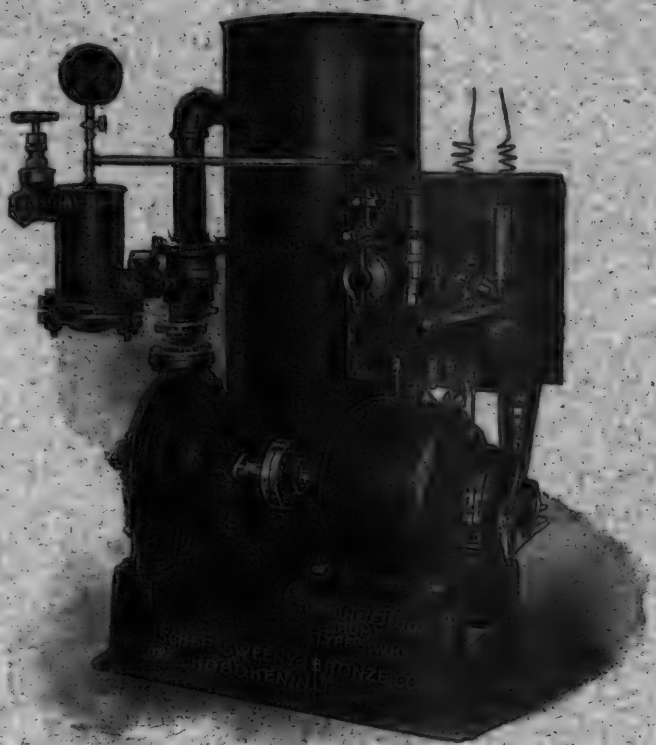
Insure a Dependable Vacuum Heating System by Specifying The Turbine Ejector Pump



TURBINE EJECTOR PUMP Pats. Pending

It is applicable to both return and air line vacuum systems.

The elimination of pistons, valves, springs, belts, gears and pinions, makes the TURBINE EJECTOR PUMP practically noiseless and wearproof. No packing is required and dirt and scale cannot affect its efficiency.

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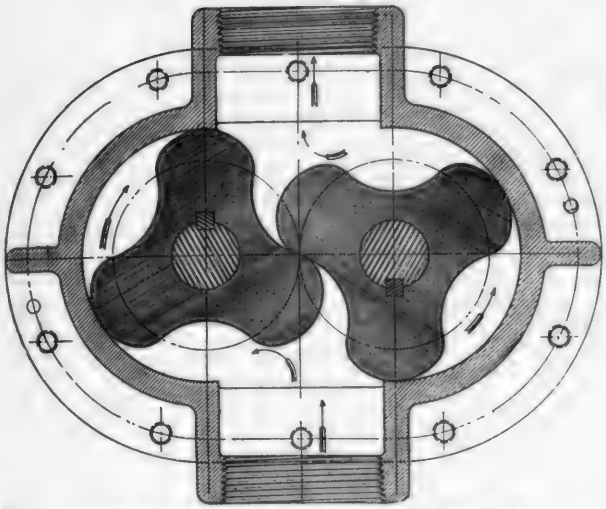

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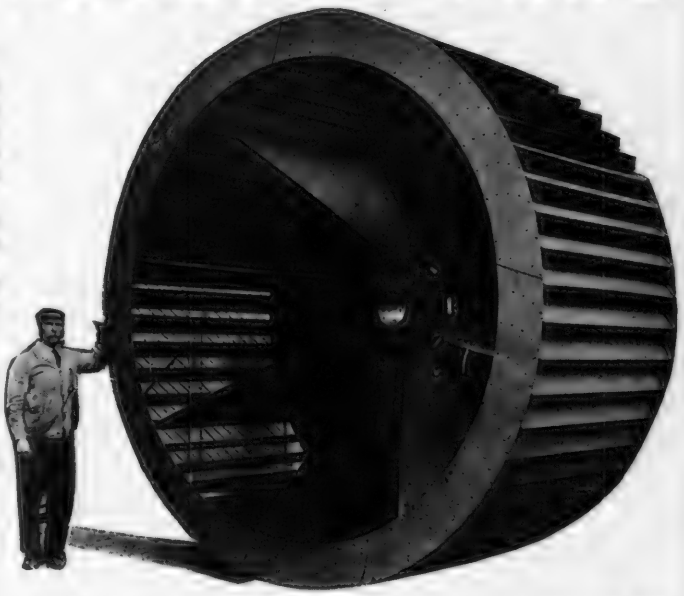
Our Perpetual Catalogue is a text book on Handling Air. Sent free.



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Interior View of Cochrane Multiport Valve

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Many plants having had a good deal of trouble, even explosions, through the sticking or overweighting of their low-pressure safety valves, for that is what a back-pressure valve is, we set out some years ago to devise an absolutely safe valve, that would also be "fool-proof."

The Cochrane Multiport Valve is the result, and it meets every requirement, for it employs a number of disks instead of one, thereby reducing the chance of sticking to the infinitesimal, and also reducing the lift and weight of the valve, which prevents noise and hammering. Further we prevent noise and reduce wear by providing an efficient dash pot for each individual disk.

Each disk is held to its seat by a light spring, which is free from the inertia effects of heavy single disks or clappers with counter-weights. No overloading is possible, nor can there be any jamming, as no part connected directly to these disks extends through the valve casing.

Another great advantage of this valve is to be found in the ready adjustment of the pressure, which can be instantly varied according to the demand for heat, thereby enabling your engineer to run your engines under the lowest practicable back pressure at all times. Nobody takes the trouble to change the pressure on an ordinary back pressure valve, because that means shifting heavy weights, puting up a ladder, or going to the top of the building to do it. But nevertheless it means that for each pound of back pressure relieved, from 2 to 3 per cent. of coal will be saved. You can carry one pressure in the morning and a lower pressure in the afternoon after you have your building heated up, and while getting all these things you also get an absolutely "fool-proof" design.

We will be glad to submit further particulars. Ask for **"The Evolution of the Cochrane Multiport."**

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You Can't Prevent Condensation But You Can Make It Pay

A HEAT unit saved is a heat unit made, and every heat unit in *your* plant's condensation can be utilized to an advantage, in favor of the coal pile, if it is saved and returned direct to the boiler with the

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Condensation from any steam heating or cooking apparatus must be removed to get Efficiency. The Morehead System does it quicker, easier and makes better use of it than any other means or appliance.

In countless tests, Morehead Traps have proved their superiority to all other condensation handlers. They have proved actual savings of 10 to 30% in fuel costs. They have admittedly increased power production from 10 to 20%. They have given longer and better service to *nearly half* the factory world. Yet, with all this evidence before you, you cannot judge Morehead Traps except by the *results in your own plant.*

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It will tell you in a plain, practical way what the MOREHEAD SYSTEM will do for *you* in reducing *your* factory costs and in increasing *your* factory efficiency. A copy of this Book should be in the hands of every practical Heating Engineer.

It is free for the asking.

If, at the same time, you will tell us about the conditions in your plant and what you want to accomplish, we will give you the benefit of expert advice and suggestions without charge. Don't delay this chance to save.—*Write today—Right now.*

Morehead Manufacturing Co.

Heating Dept. *ASK FOR NEW CATALOG* **DETROIT, MICH.**

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Combined

HOT WATER HEATER and STORAGE TANK

Both in One Shell

The "U" shaped seamless drawn brass tube heating surface is placed at the lowest point of the tank where the cold water enters, leaving the upper and larger part for the storage of hot water ready for instant use.

Ideal for institutions, schools, association buildings where water is used for showers or wherever sudden demands are made for large quantities of hot water.

Shells of heavy boiler plate.

Tube heads of forged steel.

Any combination of storage and heating capacities can be furnished.

FRANK PATTERSON & CO.

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Representatives in All Principal Cities

THE KELSEY Warm Air Heat, Hot Water Heat, and Ventilation in One

SUPPOSE, for example, that your customer wanted warm-air heat in the residence and hot-water heat in the conservatory; what have you got that will fill the bill?

The Kelsey Warm Air Generator will do it—and more. It will not only hot-water heat the conservatory, but it will at the same time both warm-air heat and ventilate the residence.

One fire does it and no extra work in caring for it.

It will burn from ⅓ to ½ less fuel than a steam or water system.

And remember that Kelsey heat is **fresh air heat.** It heats and ventilates **at the same time.**

Send for our Dealer Proposition.

Find out how liberally we help our dealers help themselves.

Repair parts for Kelsey Generators for the North Western trade will be shipped promptly by Geier & Peppler Co., 2767 Lincoln Ave., Chicago, Ill.

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WARM AIR GENERATOR

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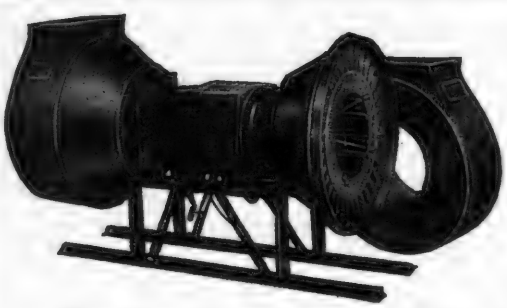

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Manufactured Exclusively by

The Hackney Ventilating Co.

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The above cut shows one of the Hackney Noiseless Blowers, which when used in connection with their system of ventilation, fully covered by patents, is guaranteed to be the only system sold or made that will bring in the necessary amount of fresh air according to what the premises are used for, their area and the number of occupants, keeping them to almost a state of purity, which we are enabled to do, because we remove the same amount of foul air at the same time. All this is done without draughts or chills, causing sickness. You will observe we thus keep the air in perfect balance.

No other system, as you probably are aware, can do this. We can distribute anywhere between three thousand and ten million cubic feet of air per hour.

Our blowers, besides being noiseless, will give more air with less horse power than any other blower of equal dimensions, thus making our system specially suitable for churches, schoolhouses, theatres, etc.

Write us for prices, catalogues, etc. Agents wanted.

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Corner Valve,
with Union

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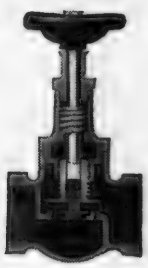

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Standard Globe Valve
for High Pressure

Unexcelled in workmanship, material and design. Made with metal-to-metal joint between top and bonnet, with another leakproof joint around the valve stem. The disc is held in place by a bronze noncorrosive spring, and the tension at all times holds the composition disc against the upper seat, making leakage impossible under all circumstances. The disc holder, which holds the composition disc forming the lower seat in the valve, is spun on the disc carrier in such a way that it may revolve, and allows the carrier to take its seat properly when closed.

The Syracuse Packless Standard Globe Valve is of bronze and is especially adapted for high pressure steam systems.

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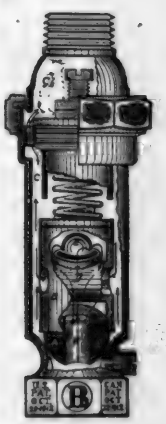

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SURPLESS, DUNN & CO., 74 Murray St., New York

Modern Vacuum Cleaning Apparatus

14. Regina Pneumatic Cleaners.

Portable cleaners, both hand and electrically operated, are included in the product of the Regina Co., 47 West 34th Street, New York. The accompanying illustrations show the two types of the company's electrically-operated apparatus. In Model B, a double pump is used, operating alternately, giving a continuous instead of an intermittent suction.

The Regina Model B contains two separate diaphragms or pumps, driven by an electric motor at a rate of 2,400 impulses per minute or 1,200 per minute for each pump. The pumping is done on the upward stroke. The eccentrics which operate the pumps run in ball bearings to reduce friction. The machine itself rests upon roller bearing feltoid casters. The working parts become accessible when the cover is removed. The dirt bag is relatively large and the collected sweepings may be removed without the necessity of taking out bolts or screws. The bag is below the pumps so that as the dust and dirt settle to the bottom of the bag, the upper part of the bag is left free for the passage of air. With this arrangement the suction may be kept high until the bag is nearly full.

REGINA ELECTRIC CLEANER, MODEL B.

The machine is placed in operation by connecting it with an ordinary electric light socket. It weighs 50 lbs., and is 18 in. long, 10¼-in. wide and 18¾-in. high.

Another model (Model C), made by this company, is mounted on rubber-tired wheels and is rolled over the floor like a carpet sweeper, but it may be also used, with hose and other extra attachments, to clean curtains, furniture, etc. It is equipped with a small, specially-constructed electric motor for direct or alternating current, as desired, operating a rapidly-revolving fan.

REGINA ELECTRIC CLEANER, MODEL C.

In this model the dust bag is not suspended from the handle but is encased between the intake and the motor. The machine may be operated as a blower by connecting a hose to the exhaust opening. This apparatus is 22 in. long, 7 in. wide and 7½ in. high.

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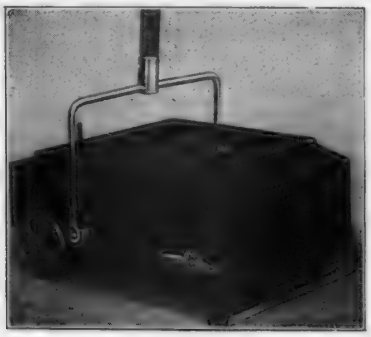

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NEW MICHIGAN CENTRAL DEPOT, DETROIT, MICH.
Equipped with **MONASH NOISELESS SYSTEM** of Vacuum Heating

Typical Layout of MONASH NOISELESS SYSTEM of Vacuum Heating furnished upon request

MONASH-YOUNKER CO.

121 West 42d Street
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TRADE AND MISCELLANEOUS NOTES

Coming Events.

Third Monday in Each Month.—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, at the Engineering Societies Building (evening).

Second Monday in Each Month.—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, in Chicago (evening).

Second Monday in Each Month.—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers, in Boston (evening).

January 20, 21 and 22, 1914.—Annual meeting of the American Society of Heating and Ventilating Engineers at the Engineering Societies Building, New York.

Deaths.

Edward C. Lewis, senior member of the firm of Lewis & Kitchen, Chicago, heating and ventilating engineers and contractors, was drowned in his bath at his home, 3620 Michigan Avenue, November 19. He is believed to have fainted, as he had complained of illness before leaving his office. Mr. Lewis was 68 years old. He came to Chicago as an associate of the late Robert G. Ingersoll when the latter was general counsel of the Rock Island Railroad. He abandoned law practice several years ago. Governor Hamilton appointed him to membership on the State Board of Agriculture. He was also a member of the Illinois Railroad and Warehouse Commission. The interment was at Ottawa, Ill. He is survived by a widow and three children,

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

PIPE CUTTERS

PIPE MACHINES, HAND OR POWER

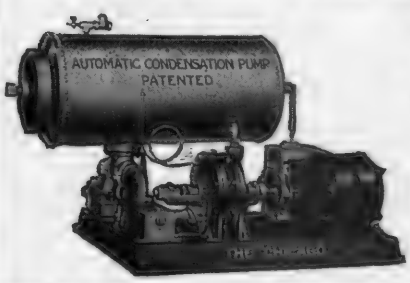
The Tools of Constant Service

Manufactured by **Write for Catalog**

THE ARMSTRONG MFG. CO., 321 Knowlton St., BRIDGEPORT, CONN.

WHY WATER LUBRICATED CENTRIFUGAL PUMPS

should not be used for pumping Hot Condensation Water! Write for latest Catalog D, describing the



"CHICAGO" Condensation Pump

which explains how a Condensation Pump should be built to be reliable.

How you can save digging a Boiler Pit.

How you can save 20 to 50 per cent. on Coal Bills.

CHICAGO PUMP COMPANY

911 West Lake Street **CHICAGO**

We also manufacture the Multi-Stage Turbine House Pump, Bilge Pump, Sewage Ejector and the Little Giant Electric Cellar Drainer.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Samuel R. Lewis, Mrs. J. H. Kitchen, of Kansas City, and Mrs. S. D. Winger, of Chicago. Samuel R. Lewis, his son, is a nominee for the presidency of the American Society of Heating and Ventilating Engineers, and has the sympathy of a wide circle of friends in his bereavement.

Henry Aird, who died in Troy, N. Y., October 10, was president of the Aird-Don Co., manufacturers and dealers in heating and plumbing supplies. He was 72 years old. Mr. Aird was one of the organizers of the Cohoes Tube Works and was a director of the Troy Trust Co. He was well known in Masonic circles. He leaves a widow, four sons and two daughters.

Miscellaneous Notes.

National Association of Purchasing Agents, Hotel McAlpin, New York, is the title and headquarters of a new organization which was effected October 16. This association will be devoted entirely to the interests of purchasing agents and buyers and will have sub-associations in all sections of the country. Some of the objects are the formation of the purchasing agents and buyers into a national body, mutual acquaintance and the resulting privilege of exchanging ideas and opinions, the standardizing of purchasing routine and methods, the investigation and certification of new appliances and materials, the improving of existing methods for the diffusion of market information, the gathering and dissemination of data relating to the subject of buying, the standardization of specifications. Over 100 purchasing agents and buyers representing industrial corporations, railroads, steamship lines, street railways, gas and electric companies in New York, New Jersey and Connecticut have become members. H. T. Leeming, of Thomas A. Edison, Inc., was made temporary chairman, and Elwood B. Hendricks, the organizer of the association, was elected temporary secretary and treasurer. He may be addressed at P. O. Box 1406, New York.

New York.—Steps were taken at a meeting of the Broadway Association, held at the Hotel McAlpin recently, to improve the system of ventilation in the present subways in New York and to provide for the best system obtainable in the new subways under construction. Many property owners, whose places of business are along the line of the old and new subways, expressed themselves as opposed to the use of gratings in the sidewalks. Reginald Pelham

NOW IS THE TIME to get after that unsatisfactory heating system. Tell us your troubles and we will advise you how to overcome them.

In most cases an "ECONOMY" AUTOMATIC CONDENSATION PUMP AND RECEIVER is all that is required.

These outfits consist of an expansion tank, an automatic switch and a centrifugal pump automatically operated by an electric motor.

They stimulate circulation by drawing condensation through system, venting the air and returning the water to the boilers at high temperature.

They eliminate snapping and cracking in the radiators and pipes.

They are a stimulant and governor to the entire system and a great saver of fuel.

Being automatic they require no attention other than an occasional oiling.

The operation is equally satisfactory on either high or low pressure systems.

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THOMAS & SMITH, Inc.

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Automatic Electric Water Systems—Automatic Electric Bilge Pumps—Automatic Electric Duplex Bilge Pumps—Automatic Steam Driven Bilge Pumps—Automatic Cellar Drainers—Automatic Sewage Ejectors—Automatic Condensation Pumps and Receivers—Single and Multi-Stage Centrifugal Pumps—Triplex Plunger Pumps—Deep Well Working Heads—Dry Pump Chamber Automatic Electric Sewage Ejectors.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Bolton stated that the system of ventilation in the present subways cost $450,000 and was not worth $4,500. Henry G. Opdyke, the consulting engineer for the association, spoke of the menace to health to pedestrians of the proposed system of forcing the foul air out of the subways by means of fans through gratings in the sidewalk and suggested the erection at half-mile intervals of stacks for the admission of pure air and others for the expulsion of foul air. James G. Dudley, a civil engineer, suggested that a prize be offered for the best solution of the problem. A committee was appointed to look further into the matter, the following being named: F. A. Muschenheim, W. De H. Washington, Reginald Pelham Bolton, George T. Mortimer, Allan Robinson, Henry G. Opdycke and Jefferson De Mont Thompson (chairman).

Toronto, Can.—The project for the construction of a central heating plant for the business district of Toronto cannot be carried out unless it is submitted to a vote of the people, as the plan involves the laying of pipes under the streets. Up to the present, the promoters of the enterprise have not been willing to have the matter submitted to a vote.

Washington, D. C.—A heating plant that will supply steam heat from a central station to all the numerous buildings at the District Old People's Home, at Blue Plains, opposite Alexandria, is in the course of construction and is expected to be in operation before the winter is over.

Muscatine, Ia.—The forced air heating system used in the cars of the Davenport and Muscatine Interurban Railway will be replaced this year with a hot water heating equipment. It was explained that the forced air system did not prove satisfactory for the reason that when the cars were traveling at a high rate of speed over the windswept prairies the circulation of the heated air was stopped so that it did not reach that side of the car facing the most exposed side.

New Orleans, La.—Dr. Dowling, president of the Louisiana State Board of Health, has ordered an inspection of all the theatres of New Orleans with a view of finding out whether the provisions of the sanitary code with reference to ventilation are being carried out. The city's ventilation ordinance applies to all public buildings, including theatres.

Saginaw, Mich.—According to a petition presented to the common council, the proposed central heating plant, for which a franchise was granted to Herbert F. Wills, is to be located between Hayden and Janes Streets.

Salt Lake City, Utah.—Application for a franchise for a heating, lighting and power plant has been made to the city commission by Robert S. Campbell for the Citizen's Heat & Power Co. The application asks for permission to lay underground conduits and pipes and to erect poles in that part of the city from the intersection of Fifth South and Second East Streets west of Third West Street, thence north to Currant Street, east to Capitol Avenue and

Jenkins Bros. Radiator Valves

excel because they are well designed, and made of a superior grade of new steam metal. The body, trimmings and all parts have strength and stability. They are made for satisfactory service, and guaranteed to give it.

Specify: "*Jenkins Bros. Valves with Diamond Trade Mark*"

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SPECIFY FOXBORO THERMOMETERS

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THE LATEST AND BEST BY EVERY TEST Send for Bulletin No. 73

New York 50 Church St. **The Industrial Instrument Co., Foxboro, Mass.** Chicago Monadnock Bldg.

Sixth Avenue to B Street, south to South Temple Street, thence east to Second East Street and south to p'ace of beginning. The plan is to supply steam for heating purposes. The estimated cost of the system is $500,000.

Cleveland, O.—The favorable outcome to the Cleveland Electric Illuminating Company of the referendum election on the extension of the company's steam heating franchise gives the company the right to give additional service in sections of the city where it already has steam heating pipes. Prospect Avenue, southeast from East 14th Street to East 22d Street is included in the franchise. Portions of Superior Avenue, N. E. and N. W., Bolivar Road, S. E. and Huron Road, S. E., are also included. The referendum vote is the last act in a long and hotly-contested fight made against the extension of the franchise by representatives of the stationary engineers' organization, who argued that passage of the grant would throw a number of men out of their positions. They stated further that they would favor a central heating system if the city took up this activity. The admiinstration heads held that the city had not the means at the time to take up municipal heating in the downtown section and any delay was not justified.

Port Jefferson Electric Light Co., Port Jefferson, L. I., N. Y., has arranged to install an underground heating system in that town. This will be the first plant of its kind on Long Island outside of Brooklyn and Queens. The work will be done by the American District Steam Co., No. Tonawanda, N. Y.

Joseph G. Hayes, vice-president and general manager of the Hayes Bros. Co., heating and ventilating engineers and contractors, was the nominee of the Republican party for councilman from the Third District at the recent election.

Chicago, Ill.—According to a decision handed down by the Appellate Court, the city of Chicago cannot force elevated roads to keep their passenger coaches heated. It was held that the city's ordinances requiring the heating of cars is not applicable to the elevated roads The decision upholds the previous verdict of the Municipal Court, rendered in a suit brought by the city against the South Side elevated roads, in which it was held that the elevated roads are organized under the general railroad act of Illinois and that the ordinance can only control those lines of traffic which do not come under the provisions of the State statute.

R. W. Newton, president of the National Steam Specialty Co., Chicago, has been spending some time at Excelsior Springs, Mo., recovering from a serious attack of pneumonia.

Joseph Graham, technical editor of Domestic Engineering, was appointed by Governor Glynn of New York to represent that State at the Sixth Annual Convention of the Atlantic Deeper Waterways Association, held in Jacksonville, Fla., November 18-20.

Central Supply Association elected the

Boiler Copings and Foundation Caps for Motors, Pumps, Fans and Blowers

Estimates Furnished on Blueprints

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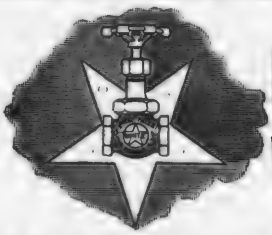

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A Complete Line of Valves for Steam and Hot Water Heating Plants. Ask your dealer or write us

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DIXON'S GRAPHITE PIPE JOINT COMPOUND

Saves Threads and Gaskets and Reduces Labor in Pipe Work

JOS. DIXON CRUCIBLE CO.

JERSEY CITY NEW JERSEY

Outfit installed in top sash of ordinary window —exhausting.

FRESH AIR

Outdoor Benefits with Indoor Comforts

by installing a

"Ventura" Reversible
ELECTRIC FAN

In tops of windows, in transoms and ends of skylights.

You can make a nice big profit from the resale of these outfits.

Our proposition is very liberal and the market is already waiting to be supplied with a reversible and economically operated ventilating fan.

Write for literature and Booklet No. 353-HV.

AMERICAN BLOWER COMPANY
DETROIT, MICH. U. S. A.

Canadian Sirocco Company, Limited
Windsor :: :: :: Ontario
Manufacturers for Canada.

following officers at its meeting in Chicago, October 22: President, C. V. Kellogg, Chicago; First Vice-President, P. J. Frey, Minneapolis; Second Vice-President, A. A. Merkel, Cincinnati; Treasurer, Edw. F. Niedecken, Milwaukee; Secretary, Paul Blatchford, Chicago.

The executive committee is composed of the following: C. V. Kellogg, P. J. Frey, A. A. Merkel, Edw. F. Niedecken, Wm. Ivy, Geo. H. Gorton, J. B. Rahm, C. A. Carothers and E. A. Morris.

The national committee is made up of the following: J. J. Ryan, W. A. Myler, John F. Wolff, F. D. Keeler and Geo. H. Bailey.

A feature of the meeting was an address on "Industrial Democracy" by Prof. J. L. Laughlin of the University of Chicago.

Chicago, Ill.—According to the reports of building operations for the past month, Chicago led the country in the total of its building construction, the figures reading $7,858,920, a gain of 9% over the same period of a year ago. New York showed a total of $6,320,496 and the figures for Boston were $5,237,000, and those for Philadelphia, $4,363,955.

W. S. Newkirk, general sales manager for the Niagara Radiator & Boiler Co., No. Tonawanda, N. Y., is receiving congratulations over the fact that he is now a grandfather.

New Firms and Business Changes.

Frederick W. Snook & Co., San Francisco, Cal., which some time ago succeeded the well-known heating and plumbing firm of W. S. Snook & Son, has applied for formal dissolution.

Charles F. Eveleth, until recently heating and ventilating engineer for the Schoolhouse Department of Boston, announces that after seven years' service in this capacity, he resigned his position October 1 to accept a similar one with Green & Wicks, architects, of Buffalo, N. Y. Plans have just been completed by this firm for the heating and ventilating apparatus for the proposed South Park High School of Buffalo. The entire building will cost, when completed, about $700,000.

Scofield-Campbell Co., 50 Central St., Boston, Mass., recently organized to conduct a general business in steam, hot water heating and ventilation, is composed of Fuller C. Scofield and John J. Campbell, both of whom were formerly connected with the Isaac Coffin Co. They have had an extended experience in heating and ventilating design and installation and the firm

is a notable addition to the important concerns in Boston devoted to this line.

Fred W. Smith, formerly vice-president and general manager of the Shirley Radiator & Foundry Co., Indianapolis, Ind., has been appointed general manager of Steel and Radiation, Ltd., Toronto, Canada.

E. W. Sanborn, assistant general manager of sales of the United States Radiator Corporation, Detroit, Mich., has resigned, to take effect January 1, 1914.

Trade Literature.

AN UNUSUAL MESSAGE is the title of a blanket circular outlining the "try out plan" of the C. A. Dunham Co., Marshalltown, Ia., in which the company offers to send a sample of the Dunham radiator trap and the Dunham air line valve for trial. In connection with the Dunham radiator trap, the offer is made that where a two-pipe vacuum job is giving trouble, the trap is to be placed upon the worst radiator in the job and left there for sixty days, to be paid for at the end of that time if it eliminates the trouble. Attenton is also called to the company's bulletins covering its line of appliances as well as containing directions for installing and operating the Dunham vacuo vapor system of heating, any of which may be had on request. C. A. Dunham Co. is one of the exhibitors at the permanent display at the Building Material Exhibit, in the Insurance Exchange Building, Chicago.

STEAM PLANT ECONOMIES DUE TO THE USE OF HOT SOFT WATER IN THE BOILER is discussed in a 28-page booklet just issued by the Harrison Safety Boiler Works, 3180 N. 17th St., Philadelphia, Pa. This publication discusses the superior results obtained by treating the water when it is hot, rather than cold. The Sorga-Cochrane hot process system of the vertical and horizontal types is also described, and the different processes employed under different plant conditions are outlined. Pp. 28. Size 6x9 in (standard).

STERLING AIR PURIFYING AND COOLING SYSTEMS, the new product of the Blomfeldt & Rapp Co., Chicago, are described and illustrated in detail in a new catalogue just issued. Among the features of the Sterling apparatus especially emphasized are its adjustable spoon spray head, its automatic flushing spray system, vertical cam shaft tripper, flooded surface eliminators, thermo humidity control, low head spray pressure and non perforated baffle plates. Details of capacities and sizes given include those capable of handling from 1,000 to 110,000 cu. ft. of air per minute. In addition to the stationary types, special interest attaches to the company's portable type whose capacities run from 800 to 5,000 C. F. M.

WM. POWELL CO., Cincinnati, O., reminds the trade in newly published circular matter that it manufactures a complete line of brass and iron valves, lubricators, oilers, grease cups, injectors and brass fittings, also that the Powell radiator valves are adapted for high grade hot water and steam heating plants.

STURTEVANT TURBO-UNDERGRATE BLOWERS as installed in the boiler plant of the New York Life Insurance Company Building in New York, are the subject of a new illustrated circular sent out by the F. B. Sturtevant Co., Hyde Park, Mass.

Manufacturers' Notes.

H. W. Johns-Manville Co., New York, announces that both its Cleveland and Baltimore branches have recently been obliged to seek larger quarters in order to take care of the company's growing volume of business. The Cleveland branch, which takes in several other cities in Ohio, has made the following changes: In Columbus the office and contract department are now located on the ground floor of the new Peters Power Building, at 45 West Long St., with warehouse facilities half a block distant. The Toledo office and warehouse have been moved to 213 Water St. This office has just completed an interesting installation of pipe covering stack lining and cork tiling in the Second National Bank Building, Toledo. Other Cleveland branch subsidiaries are located at Akron (717 Second National Bank Building), Dayton (259 Fourth Street Arcade) and Youngstown Stambaugh Building). Resident representatives are also stationed in various points in Ohio. The Cleveland branch has just closed a long-term lease for another larger warehouse on Front St., which will be remodeled for the company's use. In Baltimore the new home of the company is a modern six-story building at 207-213 East Saratoga St., near the Post Office. The new quarters will include a store and offices, in addition to large warehouse accommodations. A railroad switch will be run into the building.

Canadian H. W. Johns-Manville Co., Ltd., announces the removal of its Toronto branch to more spacious quarters at 19 Front St., East. The new store and warehouse has a floor space of 35,000 sq. ft. in the heart of the wholesale district. The entire building will be lighted by the company's Frink and Linolite system of lighting and one room will be used for exhibiting these systems of lighting.

Gardner Governor Co., Quincy, Ill., manufacturer of the Gardner automatic feed

United States Navy
United States Marine Corps
General Electric Company
Eastman Kodak Company
J. P. Morgan & Company Building
Henry C. Frick Residence
H. C. Frick Coke Company
Norfolk & Western Railroad
Shredded Wheat Company
Newport News Shipb'ldg & Dry Dock Co.
Commonwealth Pier, Boston
Girard College High School, Philadelphia

This list selected at random from the purchasers of hundreds of Multivane Fans sold during October, 1913.

EVERY MONTH'S BUSINESS shows an equally representative list of AMERICA'S LEADING INDUSTRIES.

Sturtevant
(REG. U. S. PAT. OFF.)

Multivane Fans

are specified and installed by the leading engineers and contractors because of their proven efficiency, their great durability and general satisfactory operation.

THE OLDEST AND LARGEST FAN COMPANY IN THE WORLD STANDS BACK OF EVERY **STURTEVANT** MULTIVANE FAN.

The Sturtevant Engineering Organization will co-operate with engineers and contractors in the proper designing of fan systems.

ASK FOR CATALOG 180-V

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASSACHUSETTS - and all principal cities of the world

pump and receiver and of the Gardner duplex steam pumps, announces the establishment of branch offices in the following cities, in addition to the New York office in the Singer Building, 149 Broadway, as announced last month: Chicago, Ill., room 1216 Manhattan Building, 431 South Dearborn St.; Philadelphia, 54 North 6th St.; San Francisco, Rix Compressed Air and Drill Co., 219 Spear St.

Alberger Gas Engine Co., Buffalo, N. Y., reports the following sales of engines of 50 H. P. and larger:

Hardie Bros. Co., Pittsburg, Pa.	150 H. P.
Kushequa Brick Co., Kushequa, Pa.	150 H. P.
City of Bradford Gas & Power Corp. Bradford, Pa.: 3 60-H. P. engines, each direct-connected to gas compressors.	
Apollo Water Works Co., Pittsburg, Pa.	80 H. P.
F. C. Arner, Buffalo, N. Y.	125 H. P.
74th Regiment Armory, Buffalo, N. Y.	160 H. P.
Spencer Kellogg & Sons Co., Inc., Buffalo, N. Y.	50 H. P.
Albert Zurbrick, Clarence Center, N. Y.	50 H. P.
Leon Henry, Hoboken, N. J.	125 H. P.
Garrett Co. Coal & Mining Co., Bethlehem, Pa.	60 H. P.
Bovaird & Co., Bradford, Pa.	65 H. P.

Beaton & Coldwell Co., New Britain, Conn., has acquired the business of the Eagle Mfg. Co., manufacturer of air, steam and water fittings. Additional space will be provided at the company's New Britain plant, including an addition to the company's present factory, to take care of the new line.

American Valve Co., Indianapolis, Ind., has increased its capital stock from $10,000 to $50,000.

Manufacturers' Sales Co., Philadelphia, Pa., announcement of whose incorporation is published in another column, has taken quarters at 253-255 North 12th St., occupying a salesroom 35x80 ft. It is the company's intention to maintain a display of heating and plumbing goods of various manufacturers.

Richardson & Boynton Co., New York, has appointed J. F. Esperon as one of its Chicago representatives. Mr. Esperon was formerly Pittsburgh representative for the Richmond Radiator Co.

Buffalo Forge Co., Buffalo, N. Y., announces the following recent orders for the Conoidal multiblade fans: Edison Illuminating Co., Detroit; Ford Motor Co., Detroit; Pontchartrain Hotel, Detroit; Lord & Taylor Building, New York; Masten Park High School, Buffalo; Stevens Building, Portland, Ore.; Princess and United States Theatres, Denver; Trumbull Steel Co., Warren, O.; Western Maryland Railway, Hagerstown, Md.; First National Bank, El Paso, Texas, and American Sheet & Tin Plate Co., Pittsburgh.

Joseph Dixon Crucible Co., Jersey City, N. J., announces that it still has a limited number of booklets dealing with such subjects as steam traps, unions for steam pipes, feeding graphite for lubricating purposes, etc., which will be sent free as long as the supply lasts. Engineers who keep a file of books for reference will no doubt be interested in these treatises, which were prepared by W. H. Wakeman, who has written many articles on practical engineering problems. Numerous illustrations are included in the booklets to make each subject easily understood.

New Incorporations.

Berry Window Ventilator Co., Chicago, capital $100,000. Incorporators: M. H. Berry, Hubert E. Howard and George A. Wallace.

William M. Clancy Plumbing, Heating & Construction Co., St. Louis, Mo., capital $5,000. Incorporators: William M. Clancy, Richard Hanlon, Edward C. McGrath.

Southern Plumbing & Heating Co., Nashville, Tenn., capital $5,000. Incorporators: Frank Sanders, F. E. Laughead, G. B. Dearing, M. L. Cocloud and E. F. McLaughlin.

Belmar Supply Co., Belmar, N. J., capital $25,000, to deal in heating and plumbing supplies. Incorporators: P. C. Taylor, C. Taylor and M. W. Crane, of Belmar.

Radium Heater Co., Beaver, Pa., capital $5,000.

Clark & Jones Heating and Ventilating Co., Lima, O., capital $25,000, incorporated to take over the heating and ventilating engineering business of Clark and Jones.) Incorporators:) W. A. Clark, Jacob Piper, Frank J. Banta, E. M. Gooding and D. E. Baxter, Jr. The firm reports a growth of business from $8,581 in 1908 to $41,587 in 1912.

Brady Specialty Co., Trenton, N. J., capital $50,000, to manufacture heating and plumbing specialties. Incorporators: James G. Brady, Joseph E. Stevenson and Frederick R. Brace, all of Trenton.

James Hunter Heating & Contracting Co., New York, capital $10,000. Incorporators: James Hunter, Henry B. Hunter and William Hunter, 59 Elm St., New York.

Manufacturers' Sales Co., 253-255 North 12th St., Philadelphia, capital $5,000, to represent manufacturers of heating and ventilating systems and specialties for high and low pressure installation. The president of the new company is Warren G. Culbert, formerly of Philadelphia, manager of the McCrum-Howell Co. The secretary and treasurer is Edward D. Mendell. The company will take over the business of Edward D. Mendell, Land Title Building.

Bangor Steam Heating Co., Bangor, Pa., capital $5,000. Directors: H. M. Acker-

Examine Carefully this Spray Nozzle

See How Simple It Is

Notice the large orifices through which the water is forced. No opportunity there for clogging. No need for accurate adjustments —no packing to wear out and give trouble, and yet this simple contrivance is one of the most efficient spray nozzles ever designed for air washer work.

Simplicity and high efficiency have been attained in every detail of the new

Sturtevant
(REG. U. S. PAT. OFF.)

AIR WASHERS

It will pay you to investigate. STURTEVANT Air Washers are a thoroughly proven product They are installed in some of the largest and finest modern buildings. The new building of the Bureau of Engraving and Printing, Washington. D. C.; the Bancroft Hotel, Worcester, Mass.; St. Pauls Hospital, Vancouver; Standard Oil Building, San Francisco, and many others are equipped with Sturtevant Air Washers.

ASK FOR CATALOG 225-V

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS. and a principal cities of the world

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

man, C. B. Brunner and Frank Reeder, Jr., all of Easton. Mr. Reeder has been elected treasurer.

H. G. Wolff Co., Chicago, capital $2,000, to manufacture heating specialties. Incorporators : H. G. Wolff, Carl Neuberger and O. M. Mensel.

Cuyahoga Boiler Works, Cleveland, O., capital $30,000, to manufacture house heating boilers. Incorporators: John Maher, Sr., John M. Maher, William H. Batten, Henry W. Batten and M. M. Teidner.

Thomas J. Dyer Co., Cincinnati, O., capital $25,000, to engage in heating and plumbing contracting work. Incorporators: Thomas J. Dyer, formerly with the Attlesey-Dyer Co., Cincinnati; Mayme Dyer, Frank C. Winstel, Lewis C. Twachtman and John E. Fitzpatrick. The new company is arranging to commence business operations in January.

Independent Heating & Plumbing Co., Denver, Col., capital $10,000. Directors: J. E. Tully, A. F. Cherry, P. C. Dunlap, W. S. Marble and H. C. Schmidt.

Gadsden Plumbing & Heating Co., Gadsden, Pa., capital $4,000. President, P. A. Gillespie; vice-president, Thomas H. Stephens; secretary, W. G. Gillespie.

Cronin Plumbing Co., Binghamton, N. Y., capital $10,000. Incorporators: Hermann L. Cronin, John J. McEvoy and Milton C. Duffy, all of Binghamton.

Kitts Steam Specialty Co., Oswego, N. Y., capital $10,000, to manufacture steam heating specialties. Incorporators: Willard A. Kitts, Richard V. Sobbie and Willard J. Kitts.

Harter Co., Waukehan, Ill., capital $40,000, to manufacture heating specialties. Incorporators: Beverly B. Vedder, Edwin J. Norgard and Ernest D. Best.

Exhaust Water Heater Co., Cleveland, O., capital $10,000, to manufacture water heaters. Incorporators: D. S. Bray, G. B. L. Dodge, G. B. Andrews, J. E. Carroll and W. C. Morton.

Contracts Awarded.

Zimmerman & Osborn, Beloit, Wis., heating and plumbing the new Besley shop building on Third Street, Beloit. The new shop is 270x70 ft. and four stories high. The contract will amount to about $12,000.

Lundgren Bros., Clinton, Ia., steam heating county home for Clinton County for $5,313.

Tholen Bros., Leavenworth, Kan., heating and plumbing new county hospital for $2,857.

Bartlett Co., Youngstown, O., heating and ventilating new school building of St. Rose, Girard.

Columbus Machine Works, Columbus, O., heating and plumbing building at Indiana Girls' School at Clearmont, at $6,000.

Kinnison Bros., Dallas, Tex., were the lowest bidders for the heating and ventilating of the new county jail and criminal courts building in Dallas. Bids for heating and ventilating, as well as those for the plumbing, were as follows: Kinnison Bros., Dallas, $43,641; F. E. Newbery Electrical Co., St. Louis, $49,100; W. C. Burns, Griffin, Ga., $45,000; Lewis & Kitchen, Kansas City, $45,485; Sodeman Heat & Power Co., St. Louis, $45.477. Plumbing bids: Hamilton Co., Dallas, $36,880; Harry Kahn, Dallas, $46,829; Home Heating & Plumbing Co., Monroe, La., $43,450; W. C. Burns, Griffin, Ga., $39,900; P. J. Reaney & Co., Dallas, $44,900; J. J. Madigan, Dallas, $47,880.

Wichita Plumbing & Heating Co., Wichita, Kan., heating city hall at Dodge City, Kan., for $3,141.

Consolidated Engineering Co., Baltimore, Md., power plant and acid heating system for the American Fertilizer Co., at Curtis Bay.

Alex Mettelka, Marshfield, Wis., extending heating plant at the Blodgett warehouse in the addition recently completed; also remodeling heating system in the armory at Marshfield.

Rautman Plumbing & Heating Co., Seattle, Wash., heating and ventilating St. Elizabeth Hospital, at North Yakima, for $23,000.

F. S. Schardein & Sons, Louisville, Ky., heating new McCroy 5 and 10-cent store on Fourth Avenue. 5,000 sq. ft. of radiation will be installed. This firm also has the contract for heating the Jenewein greenhouses and residence on the Cane Run Road at its bid of $4,000.

Tacoma, Wash.—Bids were received as follows for the installation of a power plant for the Lincoln High School.

Ben Olson, Tacoma, Wash., was awarded the contract for the construction of a power plant for the Lincoln High School in Tacoma at his bid of $21,477, and he was also given the heating and ventilating contract at his bid of $30,590. Other bids were as follows: For the power plant, C. A. Richardson, $21,500; W. B. Coffee Co., Tacoma, $23,783; Washington Machinery Depot, Tacoma, $22,086; M. A. Thompson, Tacoma, $24,000; Chas. C. Moore & Co., Seattle, Wash., $25,372; W. W. Cox, $24,500; J. C. Corbin Co., Tacoma, $24,930; Appling-Griggs Co., Tacoma, $22,800. For the heating and ventilating system: M. A. Thompson, $33,000; Appling-Griggs Co., $31,600; W. B. Coffee Co., $32,132; A. Gehri & Co., Tacoma, $30,950; C. A. Richardson, $39,555; W. W. Cox, $34,500.

Aberdeen Plumbing & Hardware Co., Aberdeen, N. D., heating and plumbing hospital building of the Indian School at Wahpeton, N. D., for $5,000.

M. B. Sanders Plumbing Co., Little Rock, Ark., heating and ventilating and plumbing new courthouse building in Little Rock for $52,000.

W. W. Cox, Portland, Ore., heating and ventilating Sellwood School for $2,891, Highland School for $1,551 and the Areletta School for $1,515.

L. W. Pomerene Co., Lincoln, Neb., heating and plumbing new industrial building and amusement hall at the Lincoln asylum for $4,999.

Dobson Plumbing & Heating Co., Lawrence, Mass., heating and plumbing new union station at Clinton, Mass., for $5,000.

Westfield, Mass.—Bids were received as follows for the heating and ventilating of the Abner Gibbs School, on West Silver Street: The Wyckoff & Lloyd Co., Springfield, $7,595; J. J. Cotter Co., Springfield, $7,870; Pierce & Cox Co., Boston, $7,897; George H. McLean, Springfield, $7,950; Holyoke Supply Co., $8,078; J. J. Hurley & Co., Boston, $8,130; Milner-Bill Co., Springfield, $8,195; A. B. Franklin, Boston, $8,200; Rourke Bros. Co., New Haven, Conn., $8,229; Libby & Blinn, Hartford, $8,379; Holyoke Valve & Hydrant Co., $8,564; Ingalls & Kendricken, Boston, $8,684; Mosely & Machin, $9,448.

Johnstown Supply Co., Johnstown, Pa., steam heating new $100,000 parochial school at that place.

Elder Mercantile Co., Ottawa, Kan., heating and plumbing new Dobson Building for $7,000.

Everts & Overdeer, Lancaster, Pa., heating and ventilating equipment for the State Sanitarium at Hamburg, Pa. The contract amounts to $82,000.

James Smyth Plumbing Co., Spokane, Wash., heating and plumbing terminal station of the Oregon-Washington Railroad & Navigation Co. and the Chicago, Milwaukee & St. Paul Railway Co. in Spokane. The contract amounts to $40,000.

Jennison Co., Fitchburg, Mass., heating and ventilating and plumbing new town hall at Leominster, Mass.

Pacific Blower & Heating Co., San Francisco, Cal., heating new Armijo High School in Solano County, Cal., for $5,885.

Ernst Hardware & Plumbing Co., Seattle, heating and plumbing West Woodland School on Sixth Ave., N. W.

Hankel & Eha, St. Paul, Minn., heating

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and ventilating new Minnesota Club building at Fourth and Market Sts. The plumbing contract went to F. J. Spriggs, of St. Paul.

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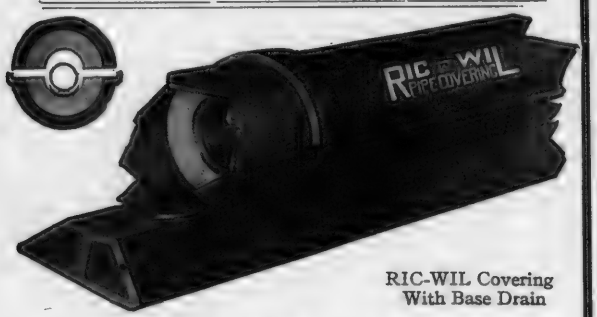

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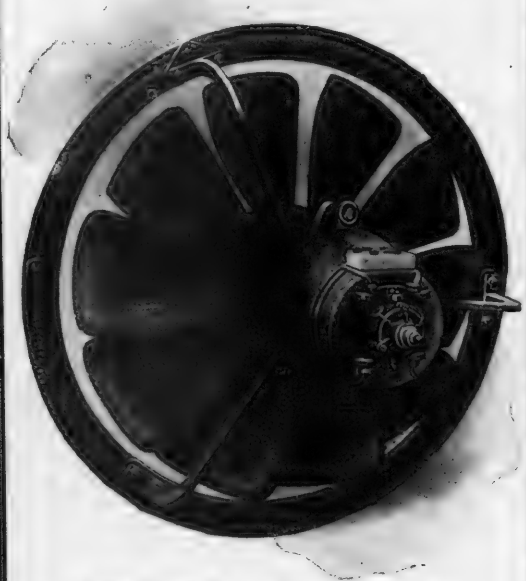

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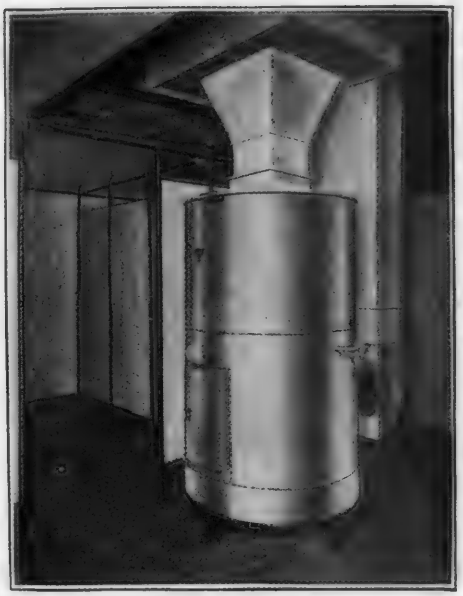

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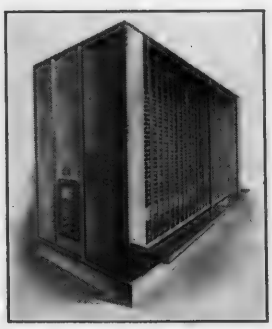

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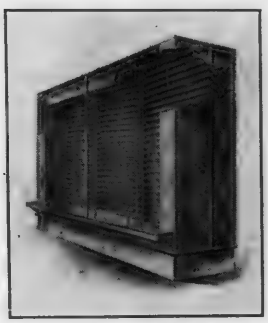

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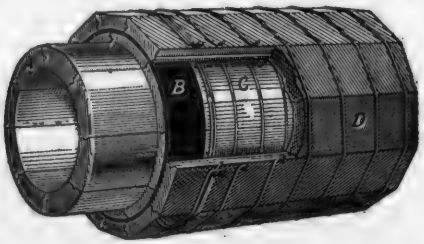

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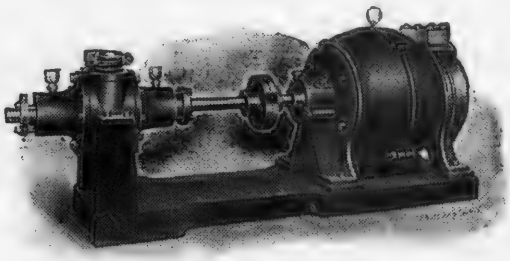

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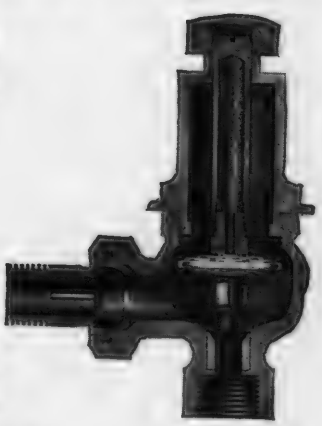

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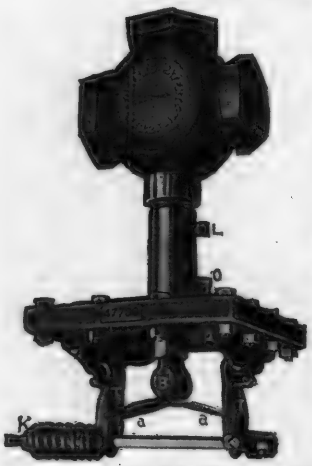

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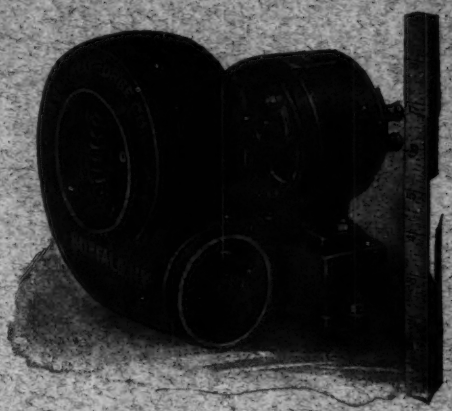

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